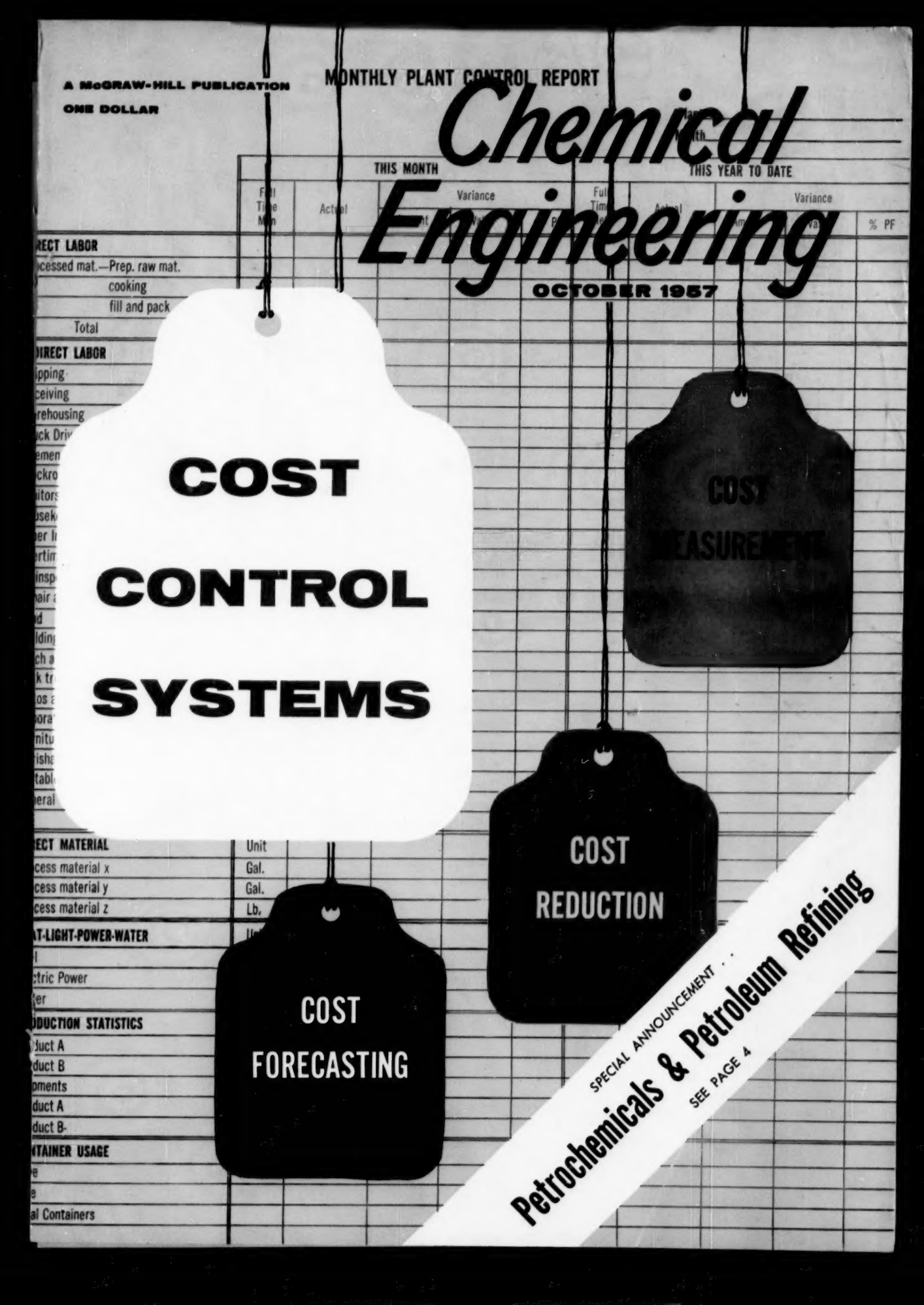
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ONE DOLLAR

Chemical Engineering

OCTOBER 1957





BUILT BY GIRDLER...



General view of new plant of Southern Nitrogen Co., Inc., at Savannah, Georgia. Produces "Dixie" prilled ammonium nitrate, urea and nitrogen solutions for formulated fertilizers.

$14-million nitrogen plant goes "on stream"

This synthetic nitrogen plant, recently built by Girdler for the Southern Nitrogen Co., Inc., Savannah, Georgia, is one of the largest in the South. It will produce over 250 tons of ammonia per day. Converted into nitrogen solutions, prilled ammonium nitrate and urea, its output will make an important contribution to farmers throughout the southeastern states in higher yields and increased profits.

As prime contractor, Girdler assumed responsibility for engineering and constructing the plant. When *your* new process plant facilities are in the planning stage, centralize responsibilities and assure profitable results —call on The Girdler Company for complete, coordinated design and construction services.

GAS PROCESSES DIVISION
. . . Design, Engineering, Construction of Hydrocarbon Processing Plants, Gas Producing Plants, Chemical Plants. High-grade specialty Catalysts. Offices: New York, San Francisco.

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OCTOBER 1957

JOHN R. CALLAHAM, Editor-in-Chief

Another Big Bonus . . . .

Within six weeks you'll get your own copy of CE's 4th Annual Inventory issue. This special issue, started in 1954 as a unique reference service for chemical engineers, will sport several new features.

▶**CE Award**—This year's biggest and most exciting award will pay tribute to the rise of chemical engineering in extractive metallurgy of the Atomic Age . . . "a renaissance that may some day rival the chemical and petroleum industries as employers of chemical engineers." CE's Inventory Issue will give exclusive details.

▶**Chem Show Guide**—To thousands of engineers across the US, the biennial Chem Show (this year in New York's new Coliseum) is the big Event-of-Events. This year CE will give, in advance, a complete guide to exhibitors, their products, where to find what. A 42-page section you can't afford to miss.

▶**New Plants**—CE's annual inventory of new plants and expansions in the chemical process industries is clearly the most complete of its kind available anywhere. This year's tally: some 590 big projects.

▶**New Chemicals**—1957's inventory of new chemicals—items especially screened for their specific interest to chemical engineers—will include 229 new or newsworthy products.

▶**New Equipment**—CE's tally of new equipment wraps up significant facts on 445 of this year's most significant advances. You can't find this information in any other publication.

▶**New Literature**—Want to expand your reference files? CE's Inventory Issue makes that super easy by listing over 2,700 literature items now available.

▶**Job Opportunities**—There's a special section here, too, in case you're looking at the job market.

Your 1957 Inventory Issue will be a timely, yet permanent, reference. Date: Mid-November.

GUIDED TOUR

The price tags on successful products reflect smart cost control

How to build your process cost control systems on up-to-date methods. How the right standards can produce eye-opening savings. Byproducts will be greater accuracy of pricing and of profit forecasting, reduced costs and better profits, and even a sounder evaluation of personnel on the basis of cost performance. (p. 233)

Flexibility in butadiene making

Three separately proved processes—dehydrogenation, extractive distillation, alkylation—team up for the first time in unique flowsheet to get both butadiene and aviation gasoline. (p. 224)

Solid "petroleum" via pipeline

How a 72-mile pipeline was designed and how its' working. It carries gilsonite slurry

Chemical

GUIDED TOUR

over Colorado's mountains to a brand new refinery that's now turning out gasoline and metallurgical coke. (p. 249)

Where is the petrochemical industry?

Vast increase in chemical from petroleum and natural gas sources gives added importance to the petrochemical industry. Our directory of petrochemical plants shows who makes what, and where. (p. 263)

How to plan shutdowns

Step-by-step procedure shows how to make complete inspection of Dowtherm vaporizers and to plan necessary repairs during scheduled shutdowns. Three steps to really effective maintenance. (p. 279)

How to get ahead professionally

Technical meetings this year have broken out in a rash of discussion about the young engineer and what he can do to develop himself professionally. Here's what some of the experts have been saying. (p. 331)

CE is edited for the engineer concerned with chemical operations, whatever his function . . . administration, production and plant operations, design and construction, research and development, sales and purchasing. More engineers subscribe to CE than to any other magazine in the field. Print order of this issue:

46,854

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Chemical Engineering (with Chemical & Metallurgical Engineering) is published monthly with an additional issue in Mid-November by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office: 99-129 North Broadway, Albany 1, N. Y. See panel below for directions regarding subscriptions or change of address.

Executive, Editorial, Circulation and Advertising Offices: 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscription rate in U. S. and Possessions for individuals in the field of the publications $3 per year (Canada $4), single copies $1. **Position and company connection must be indicated on subscription orders.** Send to address shown in box below.

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Postmaster: Please send form 3579 to Chemical Engineering, 330 West 42nd St., New York 36, N. Y.

Special: Turn page for news of importance to every CE reader

OFFICE OF THE PUBLISHER · WALLACE F. TRAENDLY
CHEMICAL ENGINEERING

Dear Subscriber:

As a reader of this magazine, you should be interested in McGraw-Hill's decision to discontinue publication of Petroleum Processing, which for many years has served the petroleum refining and petrochemical fields.

This decision, influenced to some extent by the fact that Chemical Engineering has always served a considerable audience in these industries, provides Chemical Engineering with a challenging opportunity to expand its editorial services in these areas. Now, with a larger editorial staff, Chemical Engineering will devote even greater attention to basic technology in the petroleum field.

In addition, today's accelerating tempo of technological advances in chemical engineering also demands a corresponding speed-up in the communication of engineering ideas and techniques. To meet these demands for more timely technical information, and at the same time continue to serve the interests of the "whole man", Chemical Engineering will increase its publishing frequency to 26 issues a year, effective January 1, 1958.

There will be no fundamental change, however, in our publishing philosophy or editorial content. Chemical Engineering will continue to meet the specialized informational needs of the engineer concerned with chemical operations, whatever his function and wherever he may be located. But with 26 issues a year-- and a 28 per cent increase in editorial content--we will be able to implement this philosophy to a greater degree through more timely reporting of advances and trends in both processing technology and engineering techniques.

We are convinced that through these moves, you--our reader--will find increasing benefits from the pages of Chemical Engineering.

Wallace F. Traendly

Wallace F. Traendly
Publisher

Chemical Engineering

This issue's 10 top features of significance in

Petrochemicals & Petroleum Refining

More competition in petrochemical acetylene 144

New process for partial oxidation of gaseous or liquid hydrocarbons boasts improved burner, new solvent.

Smart way to firm up tank foundations 152

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Petroleum sulfonates now made continuously 154

Compact, low-cost units turn out large volumes of sulfonated lube oil additives, corrosion inhibitors.

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How to forecast and control refinery processing costs through today's latest cost accounting techniques.

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Design highlights of unique 72-mile hydrocarbon pipeline for gilsonite solids and how it's working out.

Where you'll find U.S. petrochemical plants 263

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Get hydrocarbon heat capacities—in a hurry 283

Here're methods that'll give you the quick answers for natural gas, petroleum and hydrocarbon vapors.

How to predict flow in fluidized systems 289

Basic data to help you predict when fluidization starts, how it behaves, what happens to the bed.

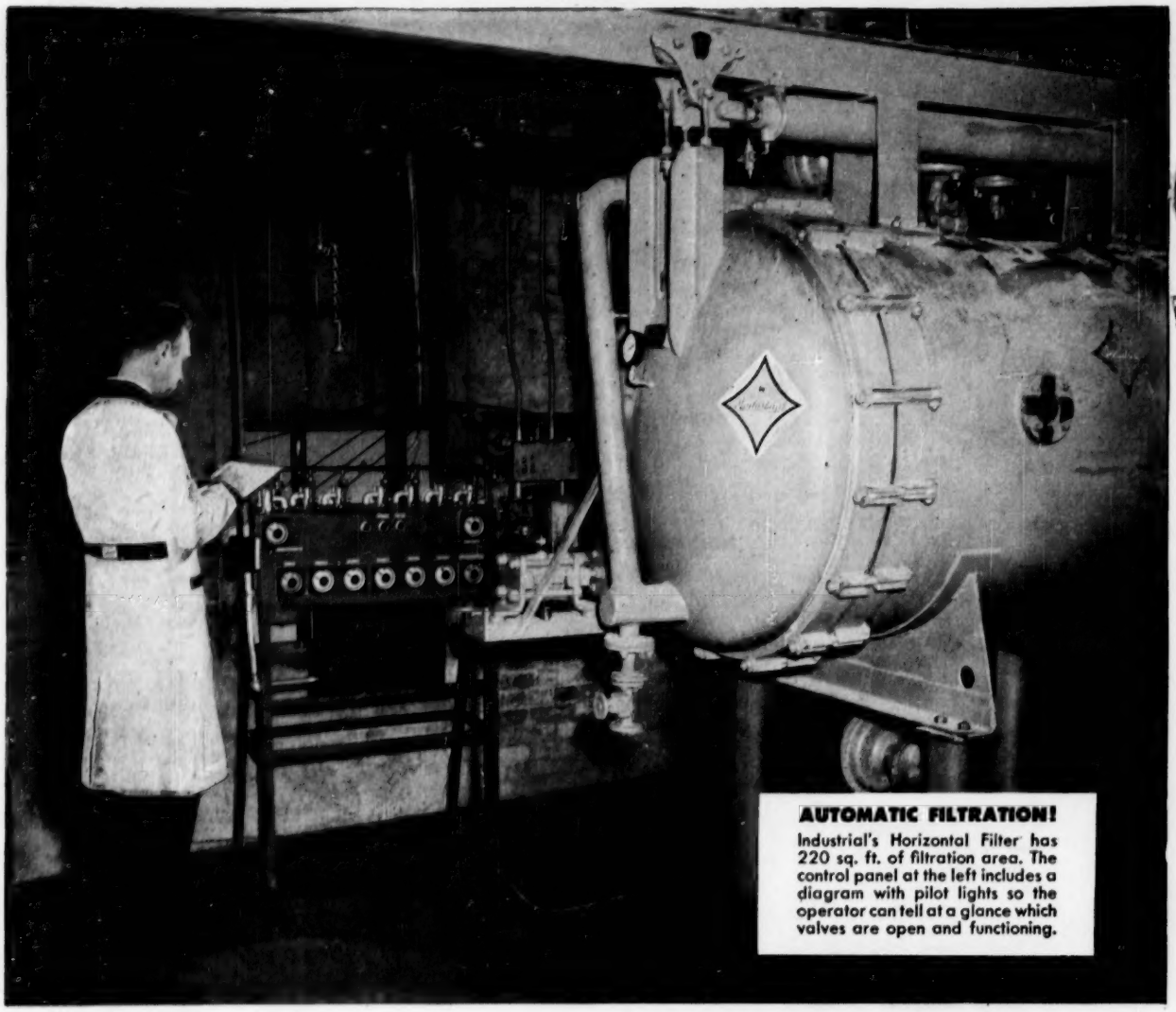
Up-to-date on aluminum for heat exchangers? 318

Petroleum processors can now take their pick from a host of alloy shapes, strengths, corrosion resistances.

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AUTOMATIC FILTRATION!
Industrial's Horizontal Filter has 220 sq. ft. of filtration area. The control panel at the left includes a diagram with pilot lights so the operator can tell at a glance which valves are open and functioning.

Different processes...different filters... all by Industrial

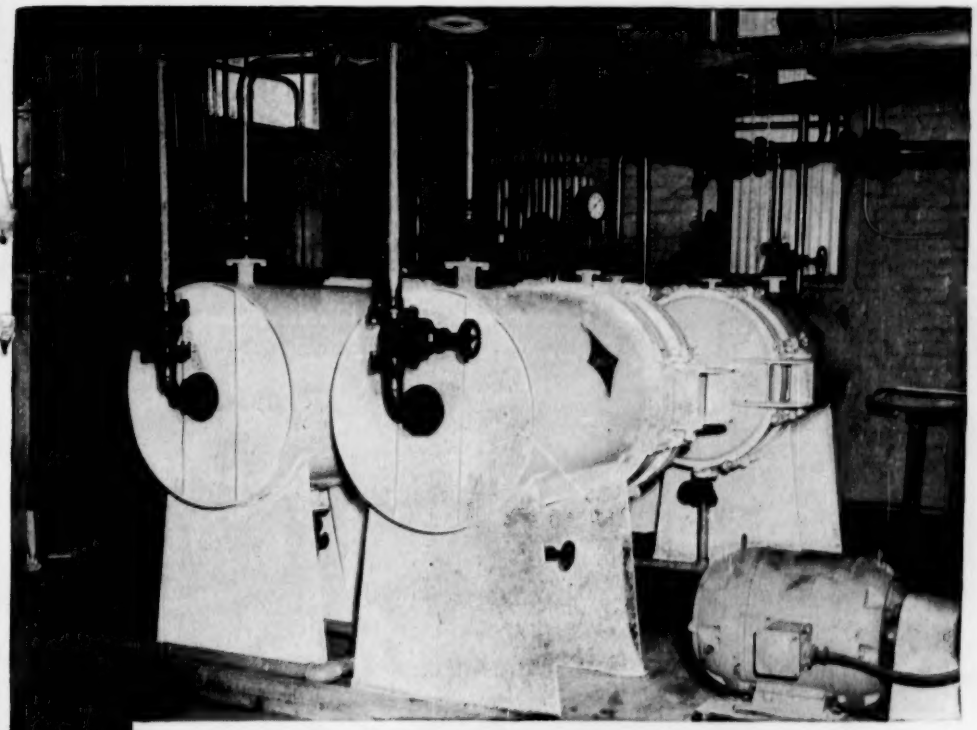
Wide range of filter types and specific engineering delivers efficient filtration for any process.

Automation tunes filter to peak efficiency at all steps in operating cycle

This Industrial filter is engineered to provide unusually complete control in filtering hot "thick" sugar liquor. The automatic controls can be set to carry out a complete cycle during which the filter fills, precoats, filters, drains, fills for shaking with a "thin" juice, shakes the filter cake off the leaves, drains off filter cake, sluices and starts to precoat again.

Automation All controls can be preset as desired to time each part of the cycle. The cleaning cycle can be started either by a timer or by a switch activated by pressure on filter cake. Variations in cycle can be obtained by simply adjusting dials and all automatic controls can be cut out for semi-automatic operation by toggle switches.

The process This filter is used to clarify sugar liquor in the second process stage. Here the sugar fluid has already gone thru one filtering operation and has been reduced by evaporation. The fluid is hot (about 150° F) and its viscosity permits a flow rate around 13.5 gallons per square foot per hour or 3000 gallons per hour for the filter. The sugar will go thru several more evaporation and filtering operations before it is ready for use as syrup or made into crystals.



Industrial's Tubular Filters. Each has 72 sq. ft. of filtering area. This type is ideal for polishing and actually costs less than scavenger or auxiliary equipment on larger filters.

Polishing sugar at 1¢ per 500 lbs.

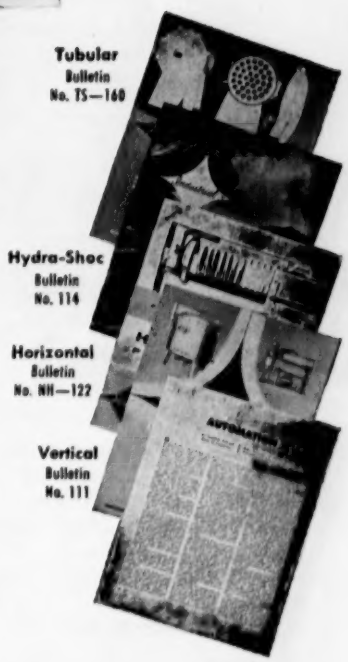
Tubular Filters were recommended by Industrial's engineers for the final clarification of the sugar liquors because they can deliver the desired results at an extremely low cost and are an economical purchase. Operated two at a time, they process 27,000 lbs. in 15 minutes, and from 5 to 11 batches can be processed before cleaning. The low cost is due to the extremely convenient design. Filtrate flows from the inside to the outside of several perforated tubes in the chambers. Filtration is accomplished by filter papers inside the tubes. Cleaning is especially easy, the filter papers are simply taken out and replaced with clean papers.

These sugar plant installations point up the reasons why Industrial is your best choice for any filtration job.

- **Industrial provides advanced engineering for specific applications.**
- **Industrial's standard units bring to your plant the fastest, most convenient and efficient filtration available today.**

SELECTION OF FILTER IS IMPORTANT

Here . . . Industrial offers you a vital service that assures you of the finest filtration system available. Industrial produces all types of filters . . . Horizontal, Vertical Leaf, Tubular, Hydra Shoc . . . and recommends, *without partiality, a filter most suitable to your particular requirements.* Industrial's accumulated engineering and manufacturing experience can be a great aid to economical processing. Many cost-saving optional features are available and almost all Industrial Filters are adaptable to complete automation. Intelligently selected, soundly engineered filters can pay for themselves in a surprisingly short time.



WRITE FOR DETAILS

Reprints of "Automation," an article from Sugar Magazine about a typical sugar installation, are available as well as folders describing all Industrial Filters, Vertical, Horizontal, Tubular and Hydra-Shoc.

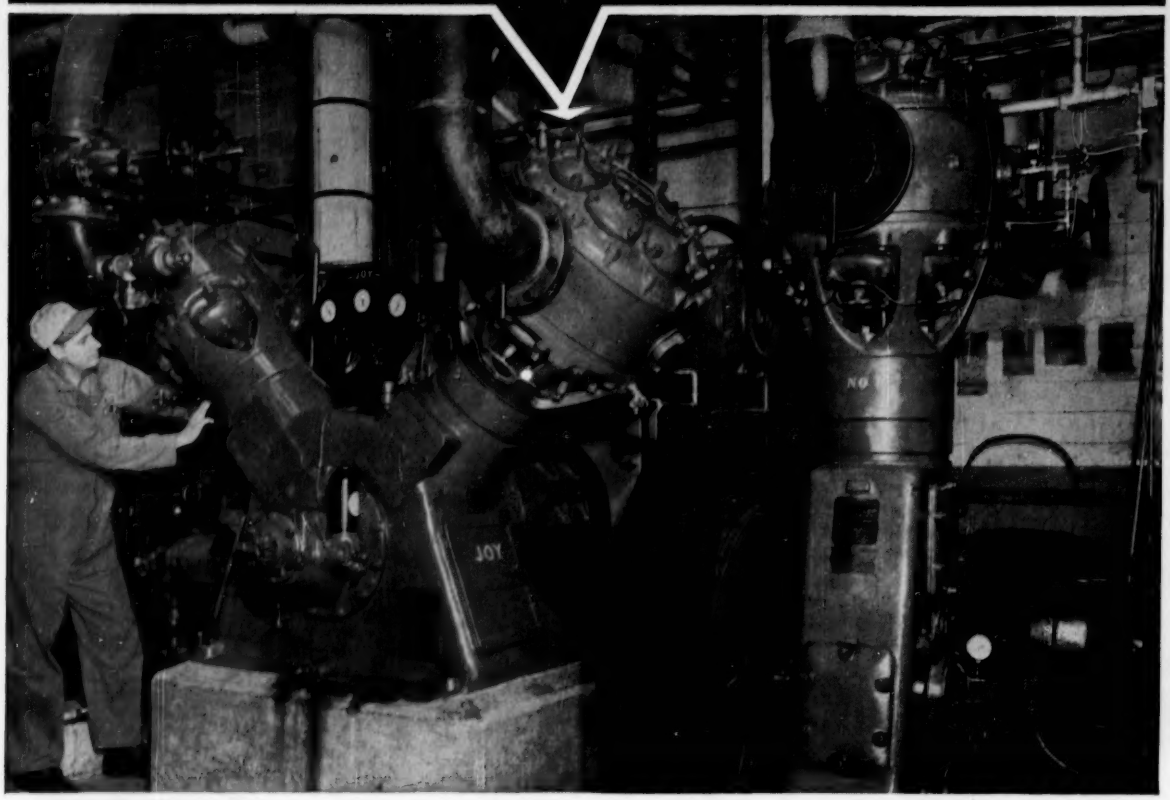
INDUSTRIAL

FILTER & PUMP MFG. COMPANY

5918 OGDEN AVENUE • CHICAGO 50, ILL.

They Needed More Oil-Free Compressed Air But Had Limited Space

A Third Joy Unit Solved it!



A West Coast Company needed more oil-free compressed air . . . in a hurry! However, there just wasn't any space in the boiler room for additional machines. They had been operating two Joy WG-9 OL vertical compressors (the machine at right in the photo). These non-lubricated compressors had run continously . . . 24 hours a day . . . for *17,000 hours with no down time.*

So they again called Joy in on the problem. The solution: One WG-9 OL with 75 hp was taken out and replaced with a Joy WN-112 E-OL rated at 150 hp. This 974 cfm machine supplies plenty of air for the new equipment, yet is compact enough to fit into the small space available.

If you need oil-free air take advantage of Joy's more than 25 years of experience with non-lubricated compressors. Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Co. (Canada) Limited, Gal, Ont.*

Write for FREE Bulletin 130-11

Consult a Joy Engineer

For Air and Gas Compressors, Vacuum Pumps and Boosters, Conveyors, Fans, Electrical Connectors.



WBW 16307-130

JOY

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so simple, so logical, so effective

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1 AIR UTILIZATION

A single fan draws air uniformly, with low draft loss, through the full height louver side walls, assuring maximum air-water contact at all levels throughout the two cooling cells. The fan is a multi-blade cast fan specifically designed by Marley for converting applied power to actual cooling tower performance. Air is exhausted through Marley VL Fan Cylinders that amplify fan efficiency and cooling performance.

2 WATER DISTRIBUTION

There can be no channeling, no dry areas in the filling of a Marley Cross-Flow tower. Primary distribution is by gravity flow through uniformly spaced porcelain orifices located at close intervals on the distribution basin floor. Secondary distribution is achieved by diffusion decks directly below the basin.

3 WATER BREAK-UP

Mortis-Locked filling continually breaks water up at very close intervals (fill decks are just 5½" apart) and momentarily retains it on the broadest horizontal surface of fill members for prolonged film cooling. Marley Cross-Flow design provides an extraordinary amount of wetted surface essential for heat transfer and more splash surface for break-up than any other type industrial tower . . . and this is achieved at lowest static pressure.

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The Welding Fittings organization — recognizing the superiority of welded piping for corrosion service — was the first to standardize, manufacture, and stock a complete line of stainless steel welding fittings.

The tee shown above—typical of all FLOWLINE Welding Fittings—provides unique features that have been developed through long, intensive specialization in design and production of welding fittings for corrosion service.

FLOWLINE fittings—tees, ells, reducers, stub ends, and caps—are available in sizes ½" through 12", in Schedules 5S, 10S, 40S, and 80S.

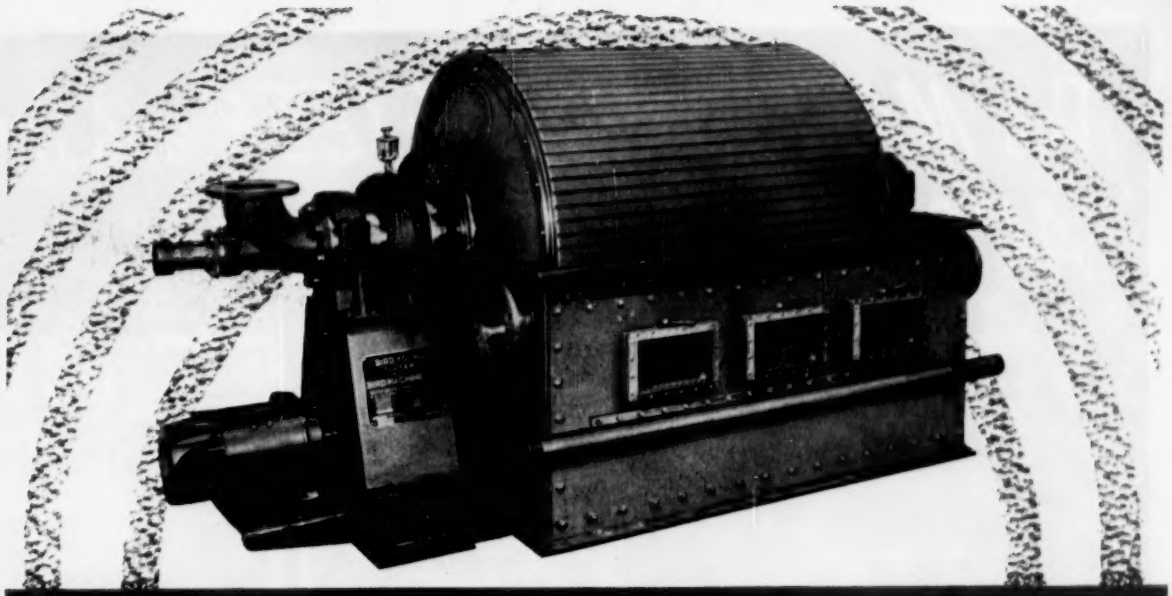
Features of FLOWLINE Tees

- Cold formed — seamless — by the exclusive Welding Fittings process.
- Reinforced crotch—tee is stronger than pipe with which it is used.
- Full center to face dimensions.
- Smooth interior walls.
- Ends machine tool cut and finished.
- Annealed, cleaned bright, passivated.
- Heat number permanently stamped on each tee as record of actual analysis and physical properties.
- Every tee is marked with type of metal, size, schedule, wall thickness, and FLOWLINE trade mark.

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FOR EXAMPLE:

You get up to five times the capacity per square foot of filter area.

On free filtering materials you have the advantage of full employment of vacuum directly under the filter medium, low internal pressure drop and completely unhampered flow of filtrate. This means a drier cake as well as maximum capacity.

On slow filtering materials you have the added advantage of *thin cake* discharge which, with high drum speed, produces several times the output plus more thorough dewatering.

You get a thorough, multi-stage, countercurrent wash with sharp separation of wash from filtrate.

You get a constantly clean filter medium due to the Bird-Young Filter's unique pneumatic *blow-back;* no scraping or doctoring.

You save real money on both installation and operating cost. Space requirements are minimum. No filtrate receivers. Cost per ton or per gallon, including maintenance, is exceptionally low.

For the story on why and how the Bird-Young Filter brings you all these significant operating advantages and economies, write for new Bulletin

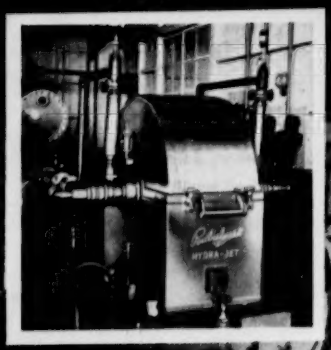
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MACHINE COMPANY

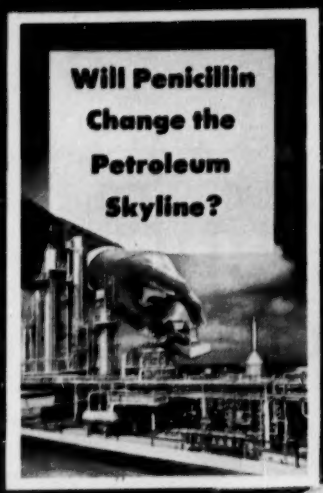
The *MASTER PUPPETEER* and the *AROUND THE WORLD!*

PODBIELNIAK CONTACTORS and SOLVENT EXTRACTORS are available in a variety of models designed for your specific process, ranging in capacity from a complete laboratory extraction plant of 500 cc per minute to intermediate and commercial size units up to 60,000 GALLONS PER HOUR

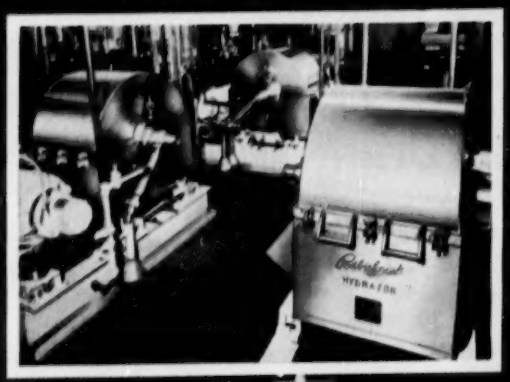
AQUAZONS
HYDRA-JETS

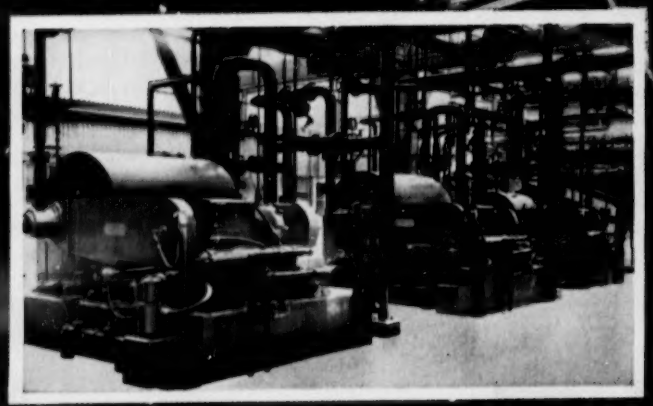


Will Penicillin Change the Petroleum Skyline?



PODBIELNIAK **HYDRAZONS** AND **DUOZONS** PROCESSING SOYBEAN OIL IN A VEGETABLE OIL REFINING PLANT





BATTERY OF PODBIELNIAK **PETROZONS** IN A MODERN PETROLEUM REFINERY



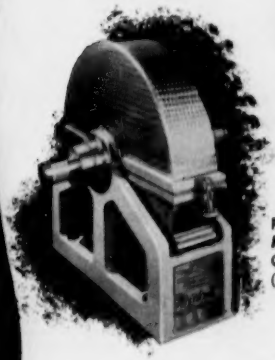
PODBIELNIAK **URANIZON** – EXPERIMENTAL WORK ON URANIUM REFINING

CHANGING SCENE



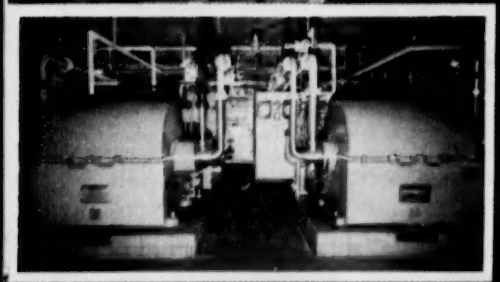
From eye-dropper capacity (200 cc/-min) to a Niagara Cascade—60,000 GPH



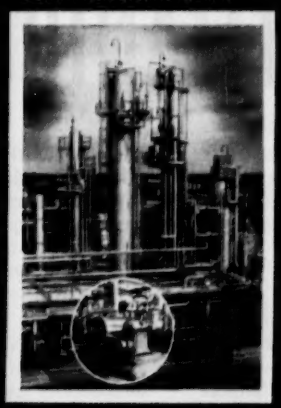


PODBIELNIAK **MIDGET** CONTACTOR (200 cc/min)

PODBIELNIAK CONTINUOUS SOAP PROCESSING PLANT



PODBIELNIAK **CHEMIZONS** FOR REMOVING PHENOL FROM COKE OVEN WASTE LIQUORS



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Insulating Oils • Lube Oil Purification

BIOZONS
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Penicillin

CHEMIZONS
Beverages • Chemicals
Coal Tar Derivatives • Coke Oven Chemicals
Germicides and Insecticides • Petrochemicals
Plastics

DUOZONS
Animal Oils • Fish Oils
Vegetable Oil Degumming

HYDRA-JETS
Antibiotics • Chemicals • Hormones
Petrochemicals • Vegetable Oils

HYDRAZONS
Animal Oils • Fish Oils
Lacquers and Drying Oils
Resin Washing • Vegetable Oils

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when should you pay $13.00* a pound for TITANIUM?

The answer is *when its cost/life ratio makes titanium less costly than other metals*—as it often does. Look at it this way . . .

More Metal Per Pound—Titanium weighs only 56% as much as steel of the same strength. Where 50 pounds of steel is needed—28 pounds of titanium will do the job.

It's Final Cost That Counts—Fabricating takes the lion's share of production costs on most jobs. Considering material and fabricating costs together usually whittles down the titanium price differential to 2 or 3 to 1. And, most important . . .

Titanium Outlasts Most Metals—even those generally considered 'corrosion-resistant,' by 10, 20, even 50 times or more.

Added together, these facts often make titanium the most inexpensive material you can use. And only titanium can provide its exceptional combination of *light-weight, high-strength,* and *resistance to corrosion.* Ask a REM-CRU engineer to give you complete details about what titanium can do for you.

**The actual cost of titanium mill products varies with the grade, size and quantity ordered. The $13.00 figure is representative of today's prices for items used in commercial applications.*

Write Dept. C-10 for the Rem-Cru Review—a free periodical presenting the latest data on titanium.

REM-CRU TITANIUM

World's Most Versatile Metal

MIDLAND, PENNSYLVANIA

Sales Offices: 6033 East Bandini Boulevard, Los Angeles 22, California • 4501 W. Cortland Street, Chicago 39, Illinois • 405 Lexington Avenue, New York 17, N. Y.

as easy as stacking coins





Hackney chemical containers stack four-high ...save shipping, handling and storage costs

Here's the lightweight, stainless steel acid container that builds a safe, compact stack—saves warehouse space and handling time for you. Bottom foot ring of the 15½-gallon Hackney chemical container fits snugly over top ring of lower barrel.

Designed with easy-to-grasp, full curled foot rings for safe, one-man handling and convenient pouring. Your name can be embossed on the bottom ring. Low tare weight reduces transportation costs. Stainless steel protects your dangerous or corrosive chemical products—eliminates breakage losses.

These 15½-gallon containers are just one of the many types and sizes of returnable shipping containers that bear the famous Hackney name. Write today for the complete Hackney Drum and Barrel Catalog.

Pressed Steel Tank Company

Manufacturer of Hackney Products

1447 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in all principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Hackney

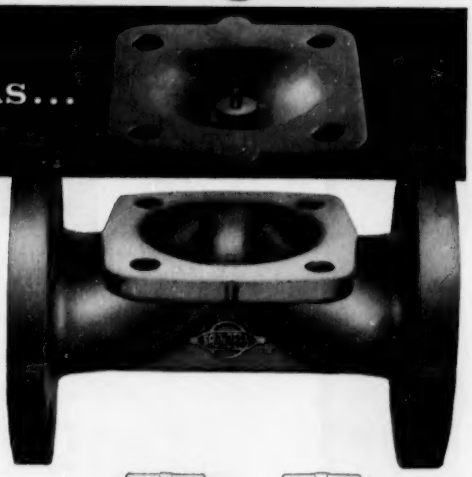
Outperforms other valves under SEVERE chemical conditions

GRINNELL-SAUNDERS DIAPHRAGM VALVES



Backing Cushion

with TEFLON Diaphragms...

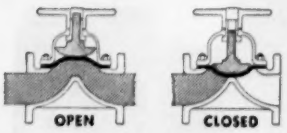


Grinnell Teflon Diaphragms are made by a special process which produces a better product of greater density, toughness and flex life.

The four case histories cited below demonstrate that Teflon offers a very high degree of chemical inertness to some of the most difficult chemicals which industry today must handle. Yet these are only a few of many success stories in the Grinnell files.

Diaphragm life depends on temperature, pressure and frequency of operation. Inquiries must include complete service data to receive prompt and careful attention.

Service Conditions	Saunders Valve	Service Life: Teflon	Service Life: Previous Material
Case 1. Benzene hexachloride (30%-40% benzene, free chlorine); 120 to 130 F, 10 to 20 psi; operated 3 to 4 times daily	Glass lined bodies; Teflon Diaphragm; 1 to 3 inches	10 to 14 mos.	1 to 2 mos.
Case 2. 90%-95% HNO_3 plus 1.8% HF (specific gravity 1.62–1.77) 115 F in summer; 40 F in winter; 125 psi; operated 2 to 3 times daily	Durimet 20 body; Teflon Diaphragm; 1 to 3 inches	8 months	2 months
Case 3. $AlCl_3$ complex; ambient to 220 F; 0-50 psi; operated 1 to 2 times daily	Glass lined bodies; Teflon Diaphragms; 1 to 4 inches	9 months	6 months
Case 4. Sulphuric acid 85%; outside temperature; no pressure; operated 4 times daily	Iron bodies; Teflon Diaphragms; 2½ inches	Still in service after 1 year	3 weeks



Features of Grinnell-Saunders Diaphragm Valves

- Diaphragm lifts high for streamline flow in either direction.
- Resilient diaphragm assures positive, leak-tight closure even with grit or scale in the line.
- Diaphragm absolutely isolates working parts from fluid . . . sticking, clogging, contamination, corrosion eliminated.
- Body, linings and diaphragm materials to suit service conditions.
- Simple maintenance. Diaphragm can be replaced easily without removing valve from the line. No packing glands to demand attention. No metal-to-metal seats to become damaged or wire-drawn.

GRINNELL

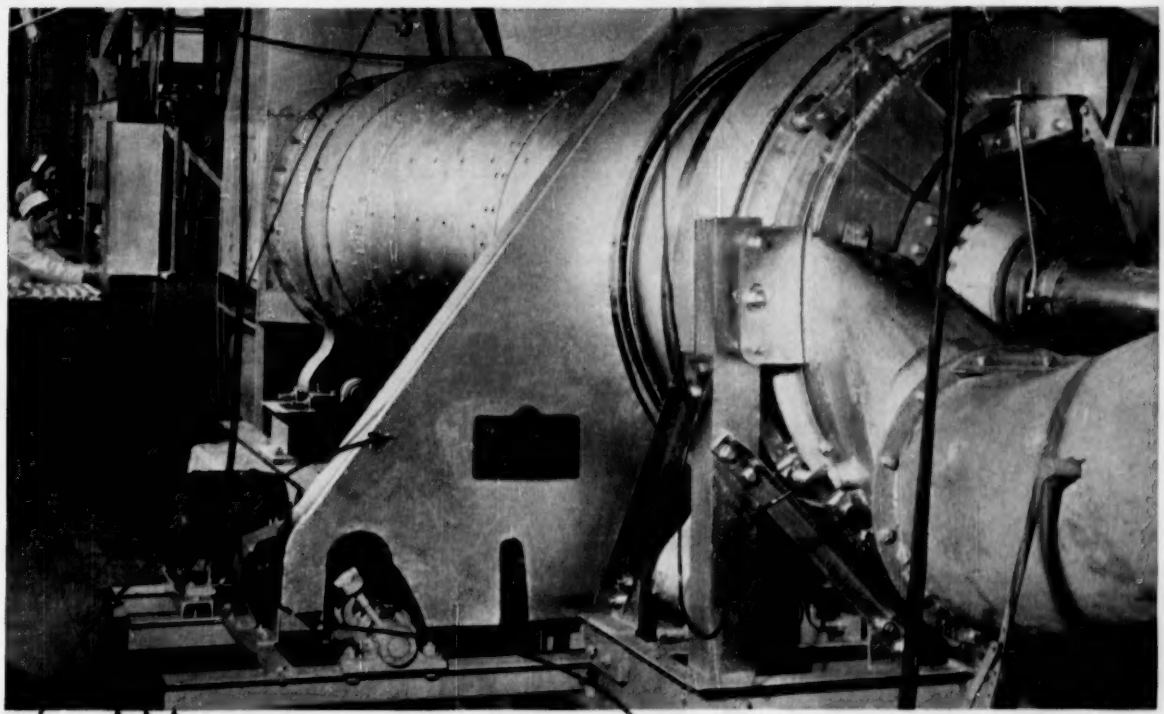
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

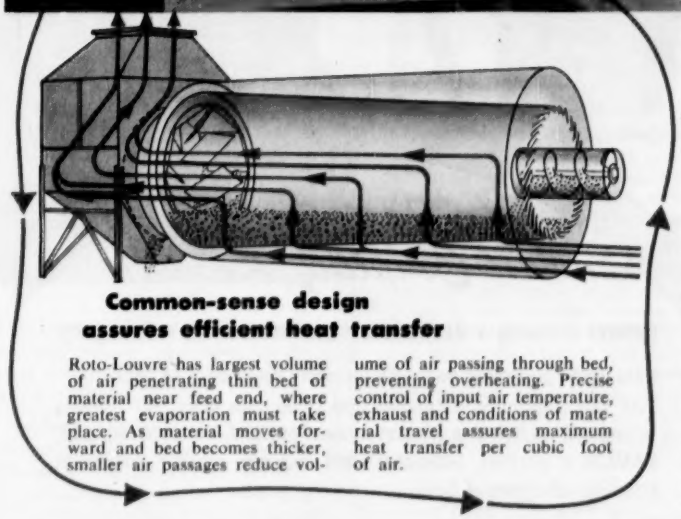
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Why the LINK-BELT Roto-Louvre dryer can

mass-produce your product with laboratory accuracy



Where rapid, continuous processing and product uniformity are essential—as in processing organic materials (above)—Roto-Louvre's efficient heat transfer excels.



Common-sense design assures efficient heat transfer

Roto-Louvre has largest volume of air penetrating thin bed of material near feed end, where greatest evaporation must take place. As material moves forward and bed becomes thicker, smaller air passages reduce volume of air passing through bed, preventing overheating. Precise control of input air temperature, exhaust and conditions of material travel assures maximum heat transfer per cubic foot of air.

Gentle handling controls quality as precisely as your pre-forming methods

If you find your product's quality varying seriously from test sample results, check your dryer. Chances are, you need the precise control and uniform processing the Link-Belt Roto-Louvre offers.

This compact, effective machine introduces dry, heated air through ever-changing channels, assuring uniform drying of the entire surface of each particle. Even friable materials or those tending to case-harden are handled successfully without sacrificing thermal efficiency or volume.

Roto-Louvre is one of several types of Link-Belt dryers. Our engineers will recommend the right one for your needs . . . or test a sample of your product in our modern laboratory.

LINK-BELT

DRYERS • COOLERS • ROASTERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,565



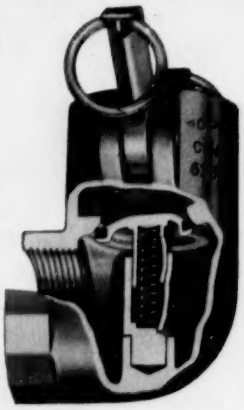
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Prudential Plaza, Chicago 1, Ill.

Please send me 20-page Roto-Louvre Book 2511.

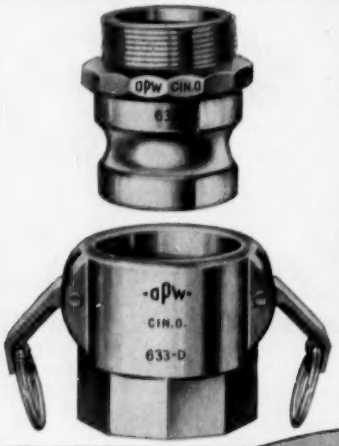
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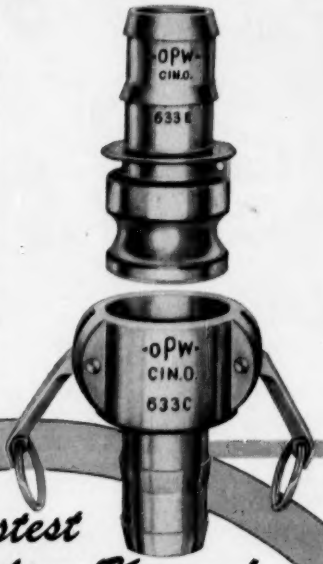
OPW KAMLOK COUPLING ASSEMBLIES

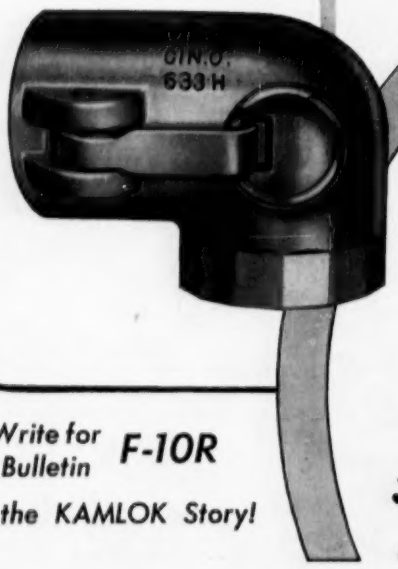












The Fastest Surest Coupling Known!

BRONZE • MONEL • ALUMINUM • STAINLESS STEEL • SEMI-STEEL

KAMLOKS couple and uncouple instantly regardless of "hook-up." Just slip adaptor into coupler and close cam arms. No threads to engage, no twisting friction against gaskets, no tools required. KAMLOK's positive leakproof seal assures greater safety in handling all types of fluids.

ALL STYLE ADAPTORS FIT IN ALL STYLES OF COUPLERS OF THE SAME SIZE.

KAMLOKS are available in any combination to meet all coupling requirements from ¾" to 6".

Write for Bulletin ***F-10R*** *for the KAMLOK Story!*

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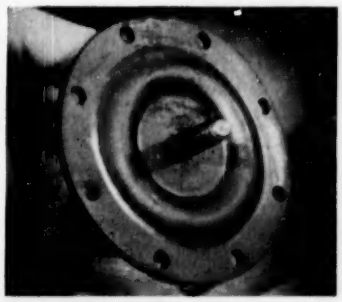


in industry

Neoprene lining protects scrubber from acid fume and abrasive grit

Exposed to 66° Be. sulfuric acid — HYPALON diaphragm gives 2 years' perfect service on acid pump

In November, 1954, a HYPALON diaphragm was installed in a proportioning pump in the plant of Fields Point Mfg. Corp. at Providence, R. I. Since that time it has been on continuous service handling 66° Be. sulfuric acid.



Before the use of HYPALON, diaphragms were oxidized and embrittled by the strong acid and had to be replaced every few months.

The diaphragm flexes about 26 times a minute through a ¼-in. stroke and is fabric-reinforced for 125 psi. service. The sulfuric goes from the pump to a stoneware tower where it dries chlorine gas from electrolytic cells.

HYPALON is a new Du Pont synthetic rubber which is noteworthy for its resistance to oxidation—by chemicals, heat, ozone or sunlight and weather. It is being used in the chemical industry for tank lining, acid hose, colored protective coatings, gaskets, valve inserts and pump parts.

For additional information about HYPALON, just mail the coupon.

Neoprene lining is still good after a year. The best of several other kinds of linings only last a fraction of this time.

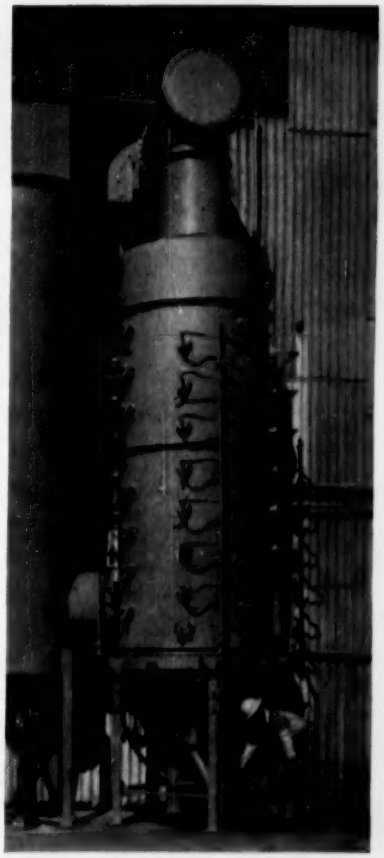
Corrosion of this scrubber once was the No. 1 production problem at the Bessemer City, N. C., plant of Lithium Corporation of America.

The scrubber cleans combustion gases from a long rotary kiln where lithium ore is given an "acid roast." Contaminants in the gas are sulfur trioxide and abrasive dust picked up from the acidified ore. Gases from the kiln pass first through a brick-and-lead-lined precooler; they enter the scrubber at 140° F. and spiral upward through water sprays to be exhausted through a fan and ductwork to a stack.

The original scrubber tank and fan were of plastic-coated mild steel, but abrasives in the gas scoured off the protective film. The fan was recoated and a temporary plastic-lined stainless steel scrubber installed. All failed, as did the stainless steel ductwork, and had to be replaced several times in the first few months of operation.

Finally, sheets of neoprene were applied to scrubber, ductwork and fan — and after a full year of round-the-clock operation, the neoprene-lined equipment was still in good condition. Equipment repairs no longer shut down production, and inexpensive mild steel can now be used instead of stainless.

Abrasion-and-acid-resistant tank linings are only one of many applications for neoprene in the chemical industry. It's used also for its resistance to oils and to weathering, and in the form of hose, belting, shoe soles, maintenance paint, protective clothing, packing, gaskets, diaphragms — any rubber item in the plant. For more information about neoprene, just clip the coupon.



Scrubber cleans combustion gases from rotary ore-roasting kiln.

DU PONT

REG. U. S. PAT. OFF.

HYPALON *is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)*

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



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☐ Send me a free copy of *The Du Pont Elastomers* (a review of properties of neoprene and HYPALON).

☐ Add my name to the free mailing list of the *Elastomers Notebook* (contains articles based on uses of Du Pont elastomers in industry).

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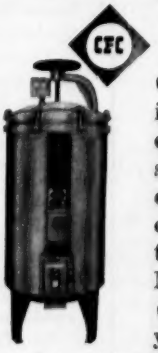
High speed filtration of hot acid solution by Fulflo Filters with Multiple Honeycomb Filter Tubes. Note simplicity of inner assembly.

There's a *Fulflo Filter* to meet YOUR EXACT NEEDS for continuous micronic clarity

Fulflo Filters give you the exact degree of continuous micronic clarity you need — for almost any chemical solution, water, various gases, liquid fuels and oils. There's a Fulflo Filter to meet *your* needs — for high or low flow rate, pressure, viscosity, *p*H, or temperature.

Standard models are designed for all normal operating conditions. Special filters are engineered for flow rates up to 2000 gpm or pressures as high as 5000 psi, at minimum pressure drop.

Fulflo employs *genuine* Honeycomb Filter Tubes in a wide range of positively controlled densities. Filter elements are made from cotton, nylon, orlon, dacron, dynel, acetate, or glass fibres. Containers are available in iron, steel, stainless steel, rubber-lined steel, or nickel-plated brass. Containers can be built to ASME or other code specifications. Lead shielded filters may be ordered for protection against atomic radiation.



CFC Oil Filters (including Honan-Crane models) effect substantial savings by prolonging equipment life and by extending the life of all types of oils. The CFC Multi-Cartridge Filter (illustrated at left) gives you a choice of six types of interchangeable cartridges for filtering both soluble and insoluble impurities in cutting, quenching and rolling mill oils; turbine and vacuum pump oils; fuel and lubricating oils.

Commercial Filters Engineers are ready to help you with any problem of micro-fine filtration. Write for technical literature to Department CE.

Micro-Fine Filtration for Low Cost Clarity



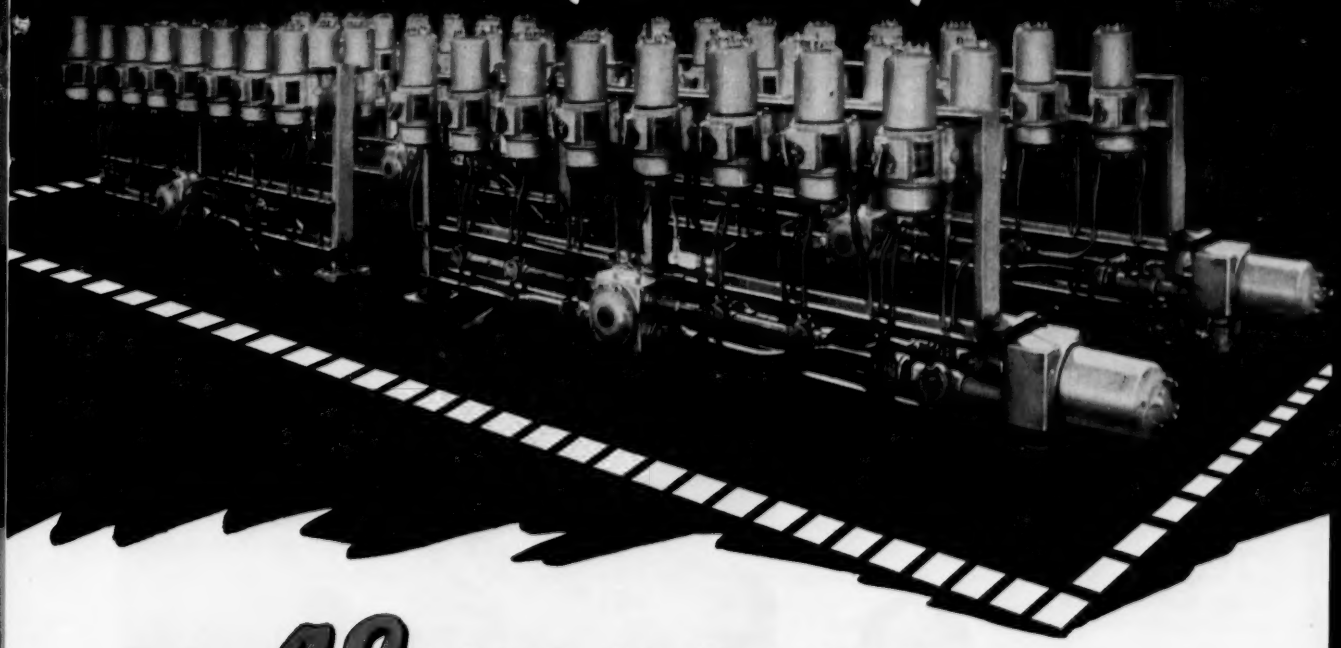
COMMERCIAL FILTERS CORPORATION

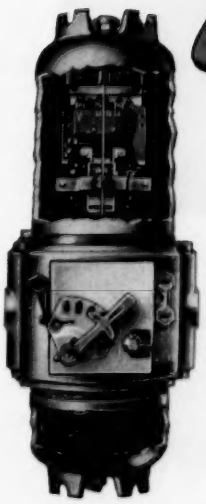
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Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
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CROUSE-HINDS
Condulet* motor controls
Occupy Less Space!





48 **Explosion-Proof Combination Motor Starters and Circuit Breakers . . . *in a 25 ft. x 6 ft. Area!***

Crouse-Hinds Condulet* Type EPC Motor Starters and Circuit Breakers are explosion-proof, dust-tight (dust-ignition-proof) and weather-resistant (raintight).

Lightweight cast aluminum construction for easy installation without use of lifting equipment.

Seven Conduit entrances simplify installation.

Built-in push button stations and selector switches are available.

Starter sizes 0 to 5. Circuit breakers 50 to 600-amp. frame sizes.

In the installation shown above, 48 Crouse-Hinds Condulet* Type EPC combination motor starters and circuit breakers are compactly arranged in four racks.

If necessary, the 25 ft. x 6 ft. area used could have been cut in half by installing the Condulet motor controls in two tiers. Or, *twice* as many Condulet controls could have been installed in the same area, if required.

The *vertical design* of Crouse-Hinds motor starters, circuit breakers and combinations allows them to be installed only ¼" apart. This compactness produces savings in the construction of steel mounting racks, and in the use of premium floor space.

● **For help in solving a space problem, see your Crouse-Hinds distributor . . . or call the nearest Office listed below**

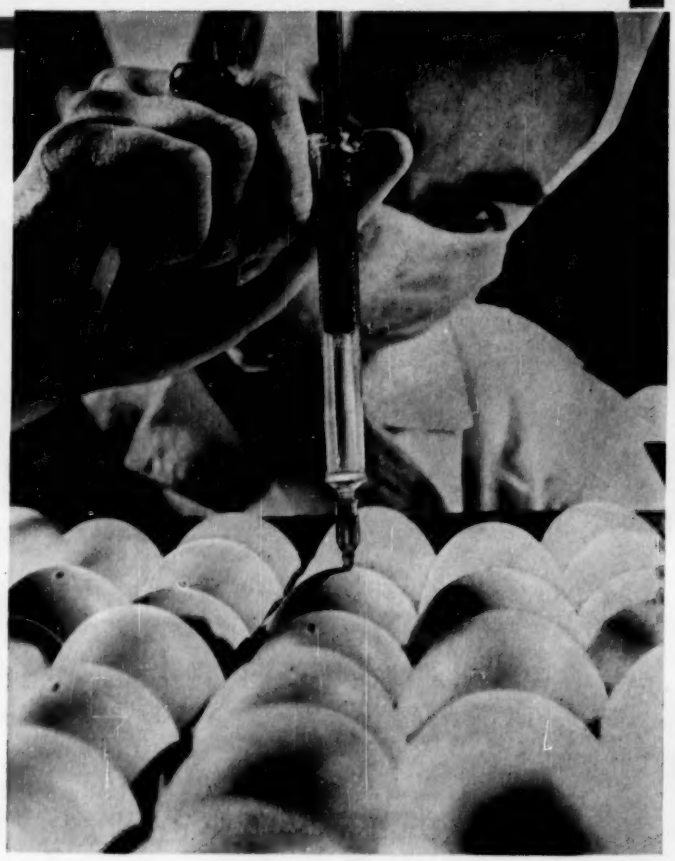
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CROUSE-HINDS COMPANY

Main Office and Factory: Syracuse, N. Y.

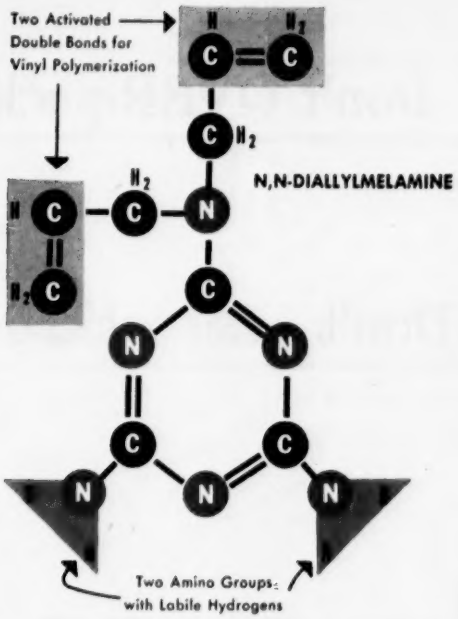
Life on the Chemical Newsfront



THE THREAT OF ASIATIC FLU VIRUS spurred a "crash" program at Lederle Laboratories in which the entire virus section was turned to producing preventive vaccine. First step is the inoculation of chick embryo with the virus strain. The harvested virus is subsequently concentrated and purified, then inactivated by formalin so that it is safe for human use and will still protect against influenza. Cyanamid's virus research center is one of the world's largest and most fully equipped, and conducts a continuing program to combat these ultramicroscopic killers. **(Lederle Laboratories Division)**



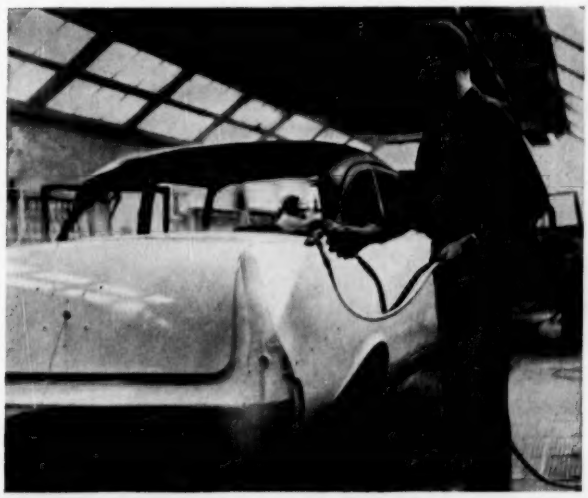
A MODERN QUALITY is given to cotton fabrics by CYANALUBE® TSI Softener. A non-ionic emulsion of polyethylene, CYANALUBE TSI Softener is added to the resin baths used in finishing processes. The tear resistance and workability of the treated cottons are improved, leading to wider use of CYANALUBE TSI "lubricated" fabrics in wearing apparel. CYANALUBE TSI is a translucent emulsion, readily dilutable in cold water and is compatible with most textile finishing agents normally employed. **(Organic Chemicals Division)**



A POLYFUNCTIONAL TRIAZINE combines the possibilities of vinyl polymerization and linear condensation. It's N,N-diallylmelamine which, for example, forms curable resins with vinyl monomers and polymerizes with Acrylonitrile to form synthetic fibers receptive to acid dyes. A dimethylol derivative is easily obtained and this converts to a hard resin suitable for thermosetting polymerization. Technical data on N,N-diallylmelamine is available from the New Product Development Department. **(Dept. B)**



NEW HIGHWAYS "MAKE THE GRADE" more easily with Cyanamid explosives economically reducing obstructing rock formations to rubble. As tens of thousands of miles of first-class roads are built in the next few years, there will be greater dependence than ever on explosives in the construction of straight, level highways meeting today's motoring requirements. Cyanamid is increasing the capacity of its New Castle, Pa. plant to meet the growing demand for modern explosives for road construction. **(Organic Chemicals Division)**



LOWER-COST, BETTER-WORKING LACQUERS are being made with AERO* Ethyl Lactate. This synthetic ester-alcohol improves the compatibility between the relatively expensive lacquer solvents and low-cost diluents, permitting more economical formulations. In addition, the low evaporation rate of ethyl lactate reduces the danger of "blushing"—the staining caused by water condensation on the lacquer surface. AERO Ethyl Lactate is a high-quality product having physical properties that are reproducible from batch to batch.
(Industrial Chemicals Division, Dept. B)

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30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

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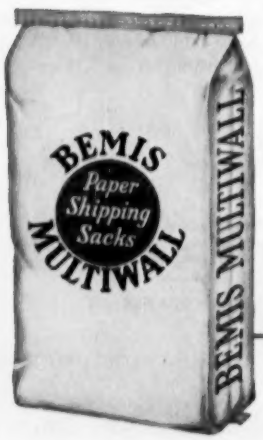
For further information on these and other chemicals, call, write or wire American Cyanamid Company

Don't OVER-package

Don't *under*-package . . .

It's easy to

package



Whatever the nature of your shipping container problem, Bemis may already have exactly the package you need. If not, we'll help you work out a practical, money-saving solution.

. . . it's costly –

You may be using drums, cartons, liners, overslipped bags or other excess-strength containers . . . which are not only expensive to buy, but pile up costs for shipping, storage space and handling.

it's costly, too –

You may, by cutting on package costs, be under-packaging . . . actually tossing money away through losses by sifting, breakage, deterioration or damage claims. Yes, under-packaging can be expensive, too.

correctly

Bemis Multiwalls, made with special protective sheets, as required, may well be your solution. They are sturdy and tough, to resist breakage. They are sift-resistant. Specified liners, laminated, impregnated or coated sheets can be utilized, for example, to pack acids, contain odors, prevent evaporation, and to meet dozens of other rigid requirements.

And Bemis Multiwalls are economical . . . in first cost, in shipping cost (they're very lightweight), and in savings on valuable storage space. *They can be your answer to over-packaging or under-packaging.*

Please write us **Bemis**

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Manufacturers of: PRESSURE REGULATORS, DIAPHRAGM VALVES

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FISHER®

E P

. . . a fast, sensitive electro-pneumatic valve positioner for dependable, accurate valve control

The FISHER E-POSITROL combines the advantages of fast transmissions from electronic controllers with the economy and dependability of pneumatically operated control valves.

The Type 3541 E-POSITROL consists of two units, First: The Type 541 Transducer, which produces a pneumatic out-put pressure that is proportional to a DC electrical in-put signal, Second: A pneumatic valve positioner (Type 3500) which accurately positions the valve stem as dictated by the pneumatic out-put pressure of the transducer.

A most important feature is that any FISHER Type 3500 Positrol valve positioner now in service can easily be converted to an electro pneumatic positioner by adding the transducer portion.

The transducer is attached to the side of a standard "Positrol" case and is available with different coils capable of utilizing a signal from any electronic instrument within the DC signal range of from .3 ma to 50 ma.

The transducer case is of explosion proof design. The FISHER E-POSITROL can be mounted on direct or reverse acting top works. Tests prove that stability, repeatability and frequency of response on this unit are excellent.

For full details write for Bulletin E-3541.

and LIQUID LEVEL CONTROLS

FISHER® Controls

Marshalltown, Iowa/Woodstock, Ontario

Since 1880

$80.00 SAVED

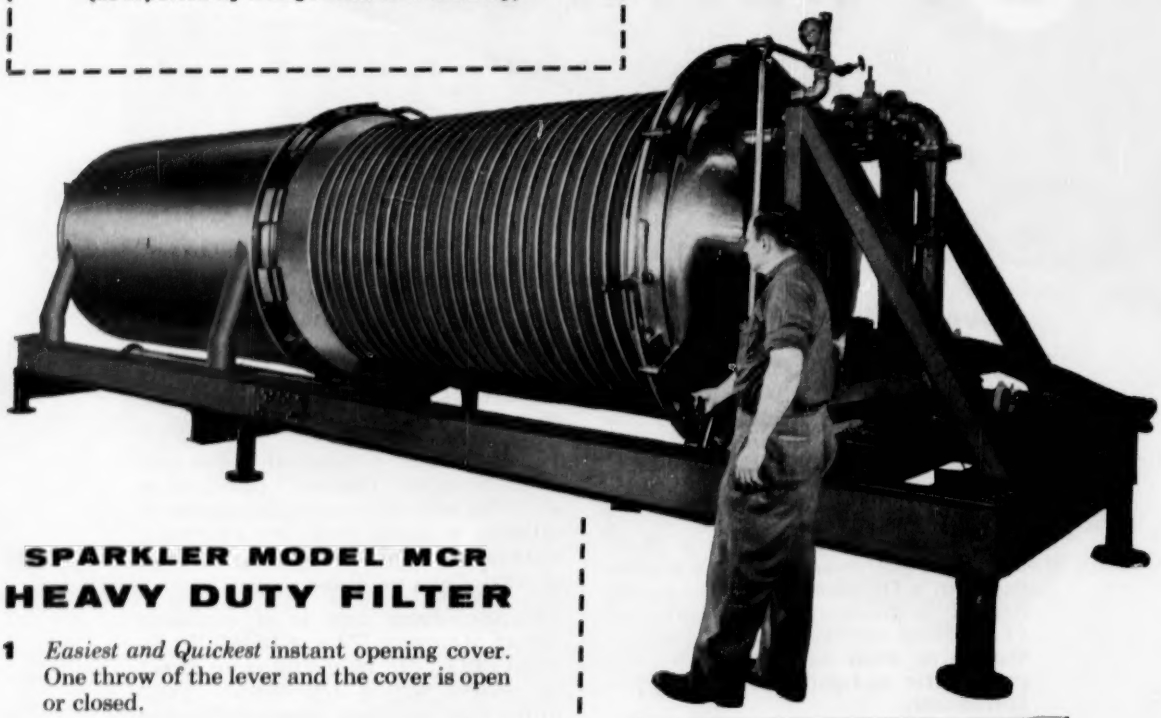
EVERY DAY IN MAN HOURS ALONE WITH THIS FILTER

(as reported by a large American Brewery)

Built to handle products with a high percentage of solids, with long operating cycles.

Engineered to lower filtration costs.
Fast cleaning with a minimum of down time.

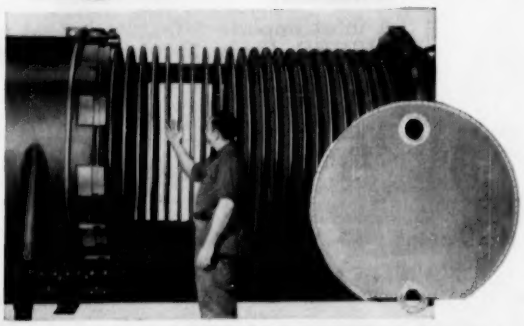
Anyone interested in reliable uniform quality, highest daily volume production, and economical operation, will not be satisfied with anything less than a Sparkler MCR.



SPARKLER MODEL MCR
HEAVY DUTY FILTER

1. *Easiest and Quickest* instant opening cover. One throw of the lever and the cover is open or closed.
2. Retractable tank, hydraulic power operated with finger tip control.
3. No breaking of pipe connections with fixed head. No spillage.
4. Plates spread far apart to allow full size cake without clogging. Large top plate outlet and bottom drainage outlet reduces flow resistance.

Write for complete facts in bulletin



SPARKLER FILTERS

SPARKLER MANUFACTURING COMPANY
Mundelein, Illinois

Sparkler International Ltd. plants, in Canada, Holland, Italy and Australia

Exclusive filtration engineers for over 30 years

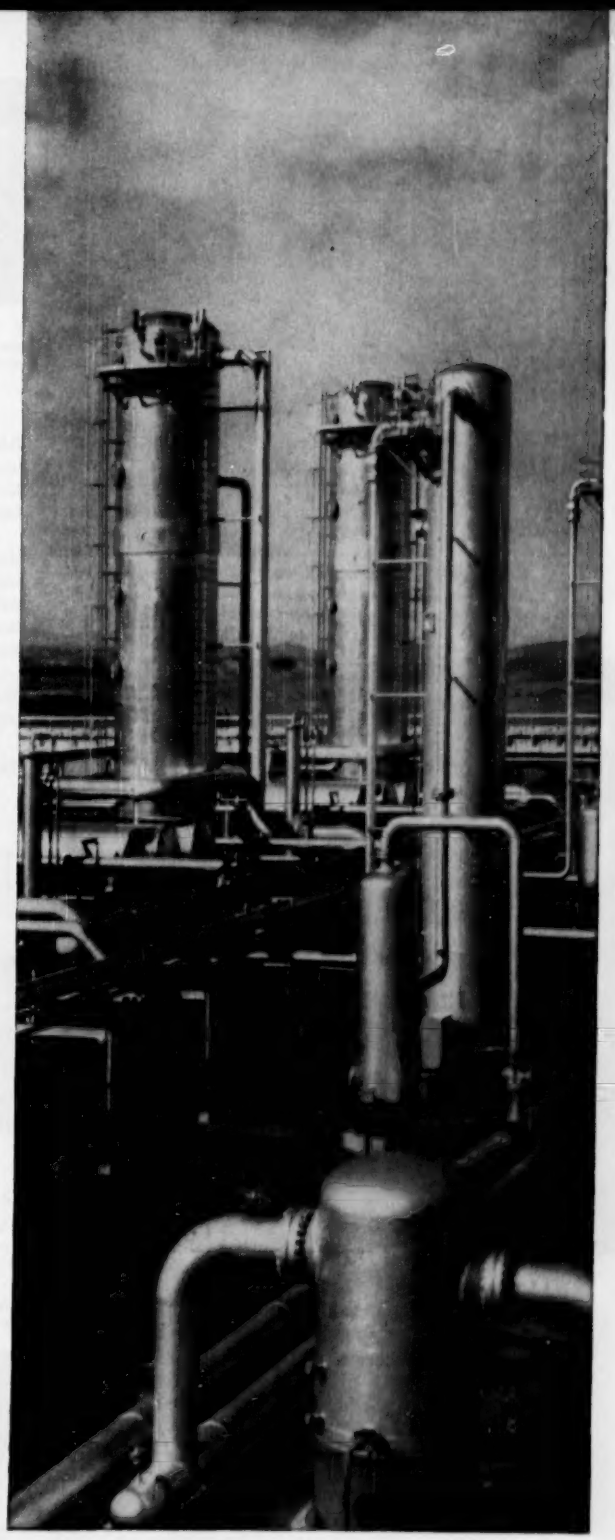
Performance-proved CURE for CORROSION HEADACHES

Specify Alcoa Aluminum for
• Process Equipment
• Transfer and Storage
• Plant Structures

Excessive maintenance and replacement of materials and equipment has fast become the biggest single headache in the process industries. Corrosion is far and away the most serious cause of such headaches. That's the big reason why aluminum—Alcoa® Aluminum—is daily being specified and installed in an increasing variety of uses throughout the process industries.

No other metal can match the ability of aluminum to resist successfully so many types of corrosive attack. And aluminum can be used to bring that unmatched corrosion resistance to a variety of applications . . . because only aluminum combines these *other* valuable properties in a single metal:

Light weight
Good workability
High thermal and electrical conductivity
Great strength in alloys
Nonmagnetic, nonsparking characteristics
Nontoxicity
Good reflectivity
Clean, attractive appearance
Low cost

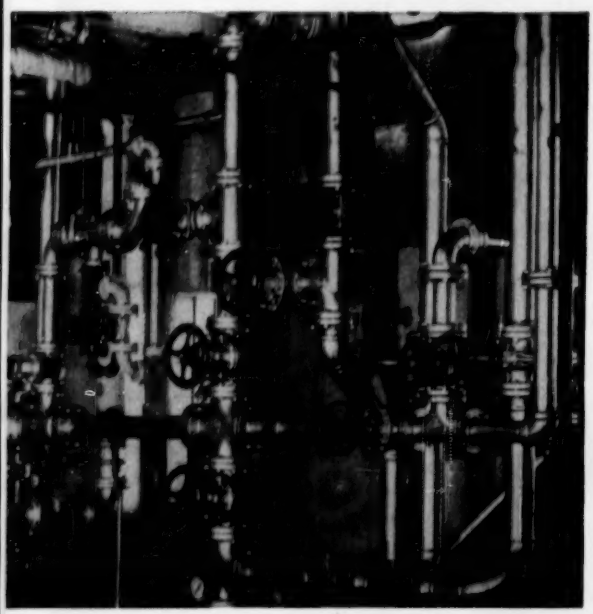


Study the next three pages to discover a few of the many process industries' uses of Alcoa Aluminum which insure outstanding metal performance . . . unhampered by corrosion. See why these various uses of aluminum have already helped hundreds of others . . . and can help you!

ALUMINUM COMPANY OF AMERICA



This brazed aluminum assembly, weighing nearly 900 pounds, is typical of exchangers used in air separation plants and other low-temperature exchange processes.



Alcoa aluminum pipe proved ideal to solve corrosion and product contamination problems in this processing plant.



A 105,000 sq ft surface condenser with Alcoa aluminum heat exchanger tubes.

heat exchanger tubes

Aluminum heat exchanger tubes are low in cost, resist oxidation and other chemical attack, are easy to fabricate, have excellent thermal conductivity and freedom from embrittlement at low temperatures.

Aluminum tubes have demonstrated their ability to give long, dependable service under severe conditions. They are used extensively in exchangers for handling hydrogen peroxide, nitric acid, hydrogen sulfide, ammonia, naval stores, glycerine, scrylonitrile and other chemicals. Alclad tubes are recommended for use with natural cooling waters.

Aluminum costs approximately ½ the cost of admiralty, less than ⅓ the cost of stainless, and in the common ¾" and 1" sizes, less than mild steel.

Get detailed information on Alcoa aluminum heat exchanger tubes in booklet AD186, available on request.

process piping

Corrosion resistant Alcoa aluminum pipe is widely used to carry liquids and gases in chemical, petrochemical, petroleum and food processing plants. It resists attack by the materials carried as well as by the corrosive atmosphere often encountered around such plants. And it prevents product contamination or discoloration.

Aluminum pipe is available in all of the normally produced schedules. It is by far the lowest priced corrosion resistant pipe available. For example, schedule 40 aluminum pipe is ¼ the cost of schedule 5 stainless, 1/7 the cost of schedule 40 stainless.

Write for *Aluminum Pipe and Fittings* booklet, AD197.

unitrace*

Alcoa now offers a new and improved design of Unitrace, the unique aluminum steam-traced pipe which incorporates the steam line as an integral part of the pipe. Extruded as a single unit of aluminum, from Alcoa 3003-F alloy, Unitrace is available in diameters equal to 1½", 2", 3" and 4" pipe.

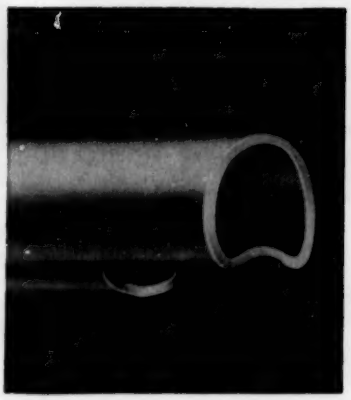
Special cast Unitrace flanges and fittings are available in alloy A356-T6 for efficient joining of sections. In many installations, flanging is not required, as sections of Unitrace can be joined easily by welding.

Preformed insulation will fit Unitrace although thermal insulation is unnecessary in many cases.

For detailed information, write for Bulletin AD418.

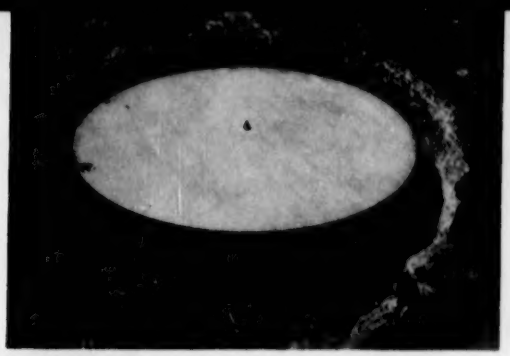
*Registered trademark

New type Unitrace section showing trace line cut back for joint. (Right) Special cast Unitrace flange for easy, efficient joining of new type Unitrace sections.





ALUMINUM COMPANY OF AMERICA



World's largest all-aluminum tank stands 26 feet high, has a diameter of 128 feet, holds 2½ million gallons of 83% ammonium nitrate solution.

standard and special storage tanks

Alcoa standard storage tanks, fabricated of 3003 alloy, are supplied in sizes ranging from 5,800 to 21,400 gallons. Both horizontal and vertical construction are available.

Made from stocked components, these standard tanks bring the user all the advantages of Alcoa Aluminum at lower cost, with faster delivery.

Storage tanks to meet many special requirements may be constructed of Alcoa sheet and plate. Information on design and fabrication will be furnished on request. Write for *Alcoa Standard Storage Tanks* Bulletin, AD387.



Alcoa Standard Tanks provide storage economies for a wide variety of chemicals.

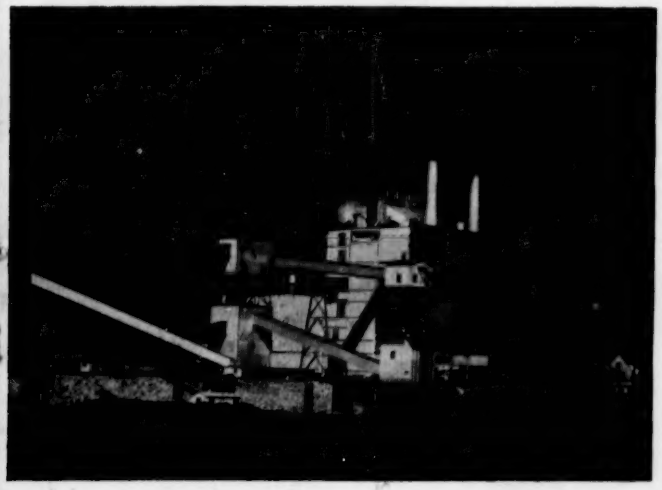
shipping containers

Alcoa offers a wide variety of shipping containers conforming to ICC regulations. Ranging in size from 7½ to 110 gallons, they are used to ship such diverse products as beer and fuming nitric acid.

Alcoa aluminum containers are lighter in weight than containers of other suitable materials, are less expensive and give longer service.



roofing, siding, structurals and paint



Alcoa industrial building sheet is used for roofing and siding on plant buildings and to protect conveyors and other outdoor equipment. The aluminum surface requires practically no maintenance and lasts well even when exposed to corrosive atmospheres often encountered around processing areas. It is easily installed and helps to keep construction costs low.

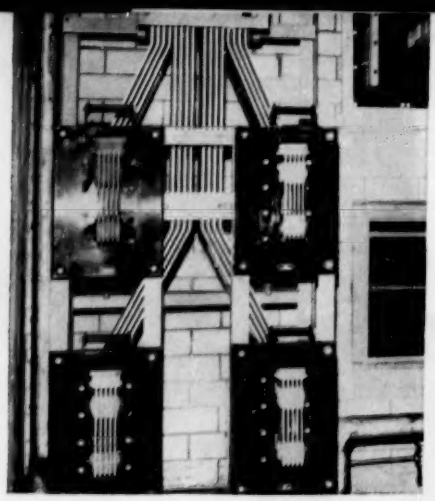
Alcoa also supplies structural shapes for use in construction where their corrosion resistance and consequent low maintenance cost are advantageous.

Paints pigmented with Alcoa Aluminum provide a continuous metallic sheet of pure aluminum for unmatched protective power.

Write for *Alcoa Industrial Building Products* booklet, AD285, *Alcoa Sandwich Walls* booklet, AD625, or *Painting With Aluminum* booklet, AD228.

Aluminum exterior surfaces for buildings and conveyors provide pleasing appearance with minimum maintenance.

ALUMINUM COMPANY OF AMERICA



bus bars

Lowest cost per unit current capacity and good corrosion resistance are key advantages for aluminum bus bars in process plants. Write for Alcoa Bus Conductor Handbook, AD661.

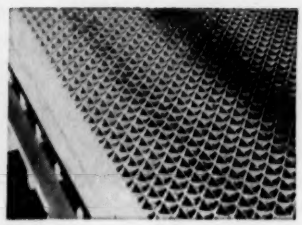
grating and tread plate

New grating-type Alcoa aluminum stair treads require no paint . . . are available in all standard sizes at a price competitive with galvanized steel and abrasive nosing. (Write for Bulletin AD679.)

Aluminum grating is used widely for floors and walkways in and around processing plants because of its light weight, resistance to corrosion, low maintenance and nonsparking characteristics.

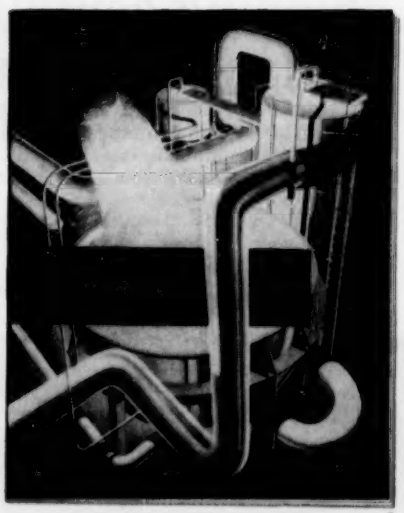
Alcoa supplies both a standard aluminum tread plate and Alcoa Abrasive Tread Plate. The latter has a self-renewing, bonded abrasive surface for extra nonskid protection. (Write for Bulletin AD596.)





this free book

. . . can be your dependable guide to solving corrosion problems in the process industries. Send for it now. Its 80 pages are filled with definitive data on the behavior of aluminum with specific materials . . . along with detailed design and specification information. Your copy will be sent promptly. Ask for Process Industries Book, AD460.



use Alcoa engineering assistance to solve your corrosion problems

In the course of many years' study of corrosion problems, Alcoa has acquired an immense fund of practical, nonconfidential information on corrosion characteristics of many materials and processes under various conditions. This information is available to you without obligation. Simply write Alcoa.

To insure receiving the most useful information, state your problem as specifically as possible. Alcoa's development engineers will then supply and help you evaluate the best available information.

Alcoa is also prepared to undertake cooperative testing programs in certain cases where existing data is insufficient. Contact your nearest Alcoa sales office for details.

Aluminum Company of America
903-K Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature (see above for booklet nos.):

_____

_____

_____

Name _____

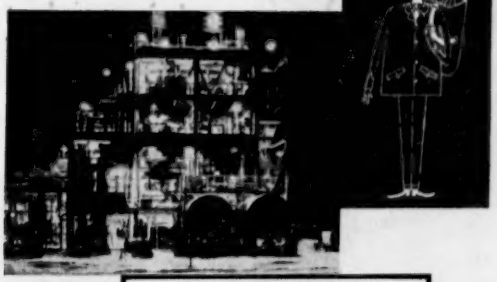
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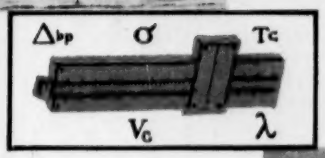
Address _____

City _____ Zone _____ State _____

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

NEW!
"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENI





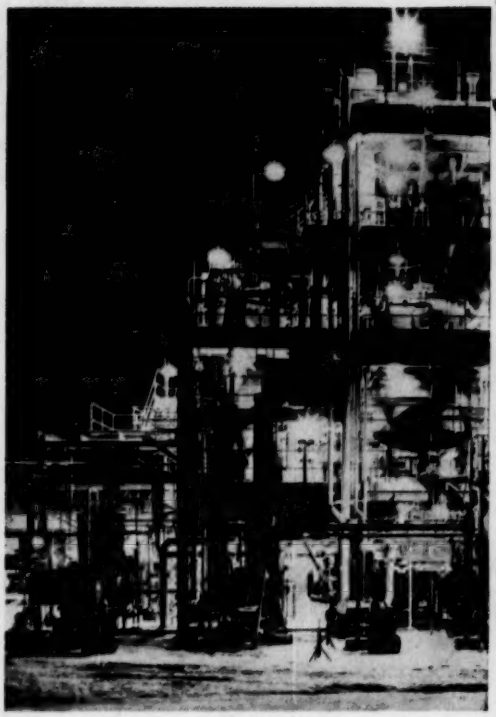
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Double Your C . . . re . . . Sell Faster

Chemical Engineering

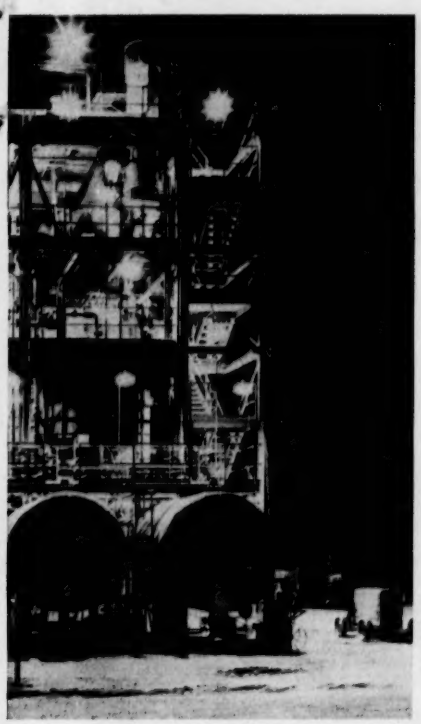


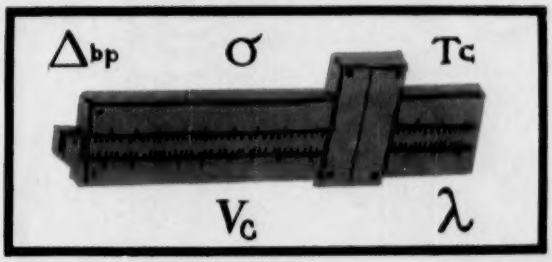
EFFECTIVE JANUARY 1958, CHEMICAL ENGINEERING WILL PUBLISH 26 TIMES A YEAR. Now you can get and keep the largest concentrated audience of key chemical engineers in industry on your side of the buying decision twice as often.



In the chemical process industries, an unprecedented rate of growth and technological advance. Particularly dramatic areas: *Pharmaceuticals, plastics, petrochemicals.* Thorough in all areas, CHEMICAL ENGINEERING's solid technical coverage of petrochemicals and petroleum refining, for example, was a strong factor in the discontinuance of Petroleum Processing. Already by far the preferred engineering magazine in these fields, only CE's broad scope can realistically anticipate and meet their expanding requirements.

26





Biweekly frequency means 28% more editorial content, faster communication of engineering techniques, intensified service to readers. Greater emphasis will be placed on growth areas like petrochemicals while maintaining the broad editorial base that has made CHEMICAL ENGINEERING—consistently—the 3 to 1 choice among chemical engineers in all industry.



In January (with a new circulation high of 44,000 paid), CHEMICAL ENGINEERING will offer the engineer even greater value for his reading minute. The chemical engineer holds many different titles, does many different jobs . . . administration, production and plant operations, design and construction, research and development, sales and purchasing. CE has always been his primary source of product information and of brand preference.

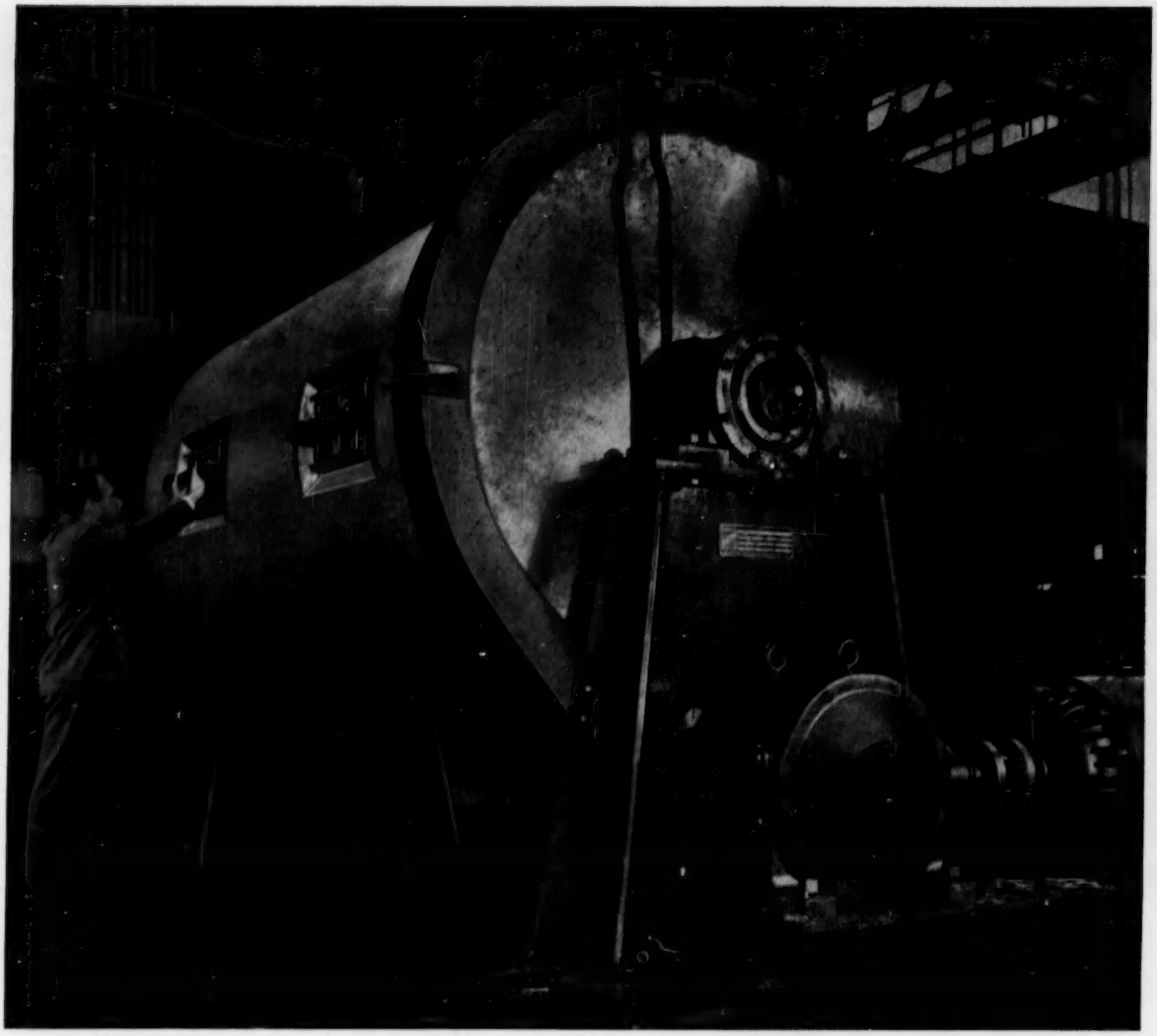
Chemical Engineering

to sell the engineer,

whatever his function

Recognized by advertisers as the industry's top "sales engineer" . . . this year, as a monthly, CHEMICAL ENGINEERING will carry about 4,500 pages of advertising . . . more than any other magazine serving any part of this market. Now you can reach CE's powerful buying audience with a timeliness and repetition impact never before possible. Wire immediately for complete details.

A McGraw-Hill Publication (ABC-ABP)
330 W. 42nd Street New York 36, N. Y.



Bigger process equipment helps fight the profit squeeze

The economic squeeze play, which finds many producers caught between rising costs and shorter profit margins, is likely to continue through 1957. In the process industries, the gap can often be widened by increasing productivity per machine hour. Dravo large scale or special purpose process equipment is ideally suited to this job.

The king size ball mill shown above is a case in point. Designed to meet specific grinding and batch size requirements, it is constructed of stainless steel. All the internal welds are ground flush and the interior polished to a smooth finish. Internal corners are provided with fillets to facilitate cleaning between batches. This large ball mill is helping the owner to step up production rate.

This type of equipment has helped many processors lick production problems by reducing labor cost. And frequently, by bringing design into complete harmony with process requirements, special purpose equipment can achieve astonishing cost reductions.

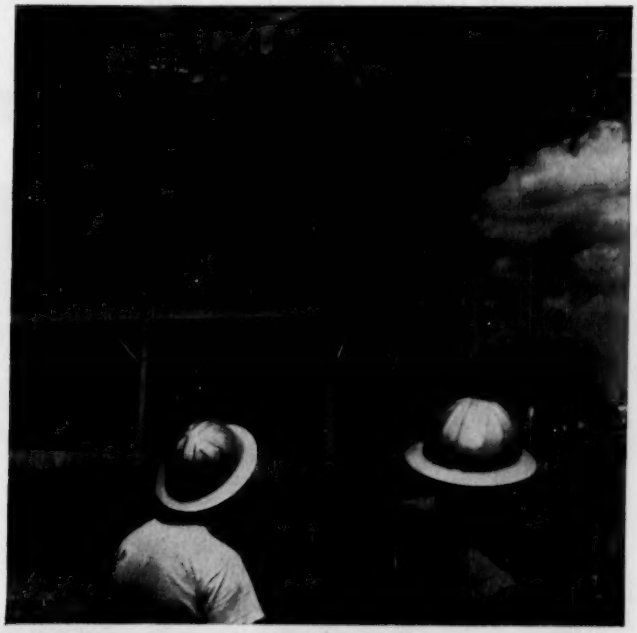
Take advantage of the engineering skill and fabricating facilities which Dravo can bring to bear on process equipment problems. Write to Dravo Corporation, Pittsburgh 25, Pa.

DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

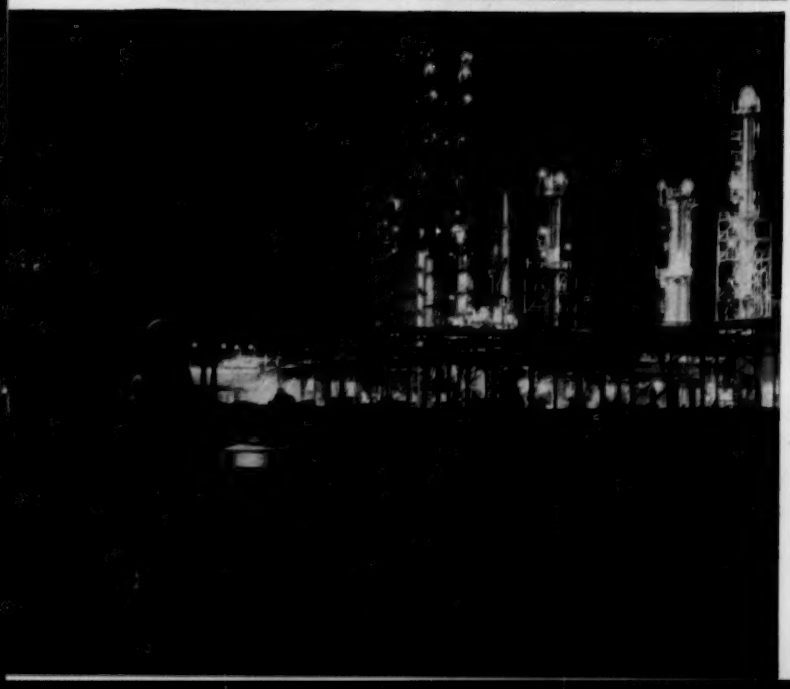
To protect process growth . . .

Take a new look at electrical system dependability



These chemical and petroleum companies did . . . and found new advantages in Westinghouse distribution equipment and engineering counsel.

American Cyanamid and Westinghouse Engineers worked out a power distribution system that prevents outages. If there's trouble on any feeder, power is switched to another. If a substation faults, other substations carry the load through cross connections. This system can be easily and inexpensively expanded as the plant grows.



Sohio's Lima Refinery achieves power dependability without paying extra for stand-by capacity. In a period of over two years, this Westinghouse equipped system handled power interruptions without loss of refinery production.

Get economy with system protection →

YOU CAN BE SURE... IF IT'S

Westinghouse

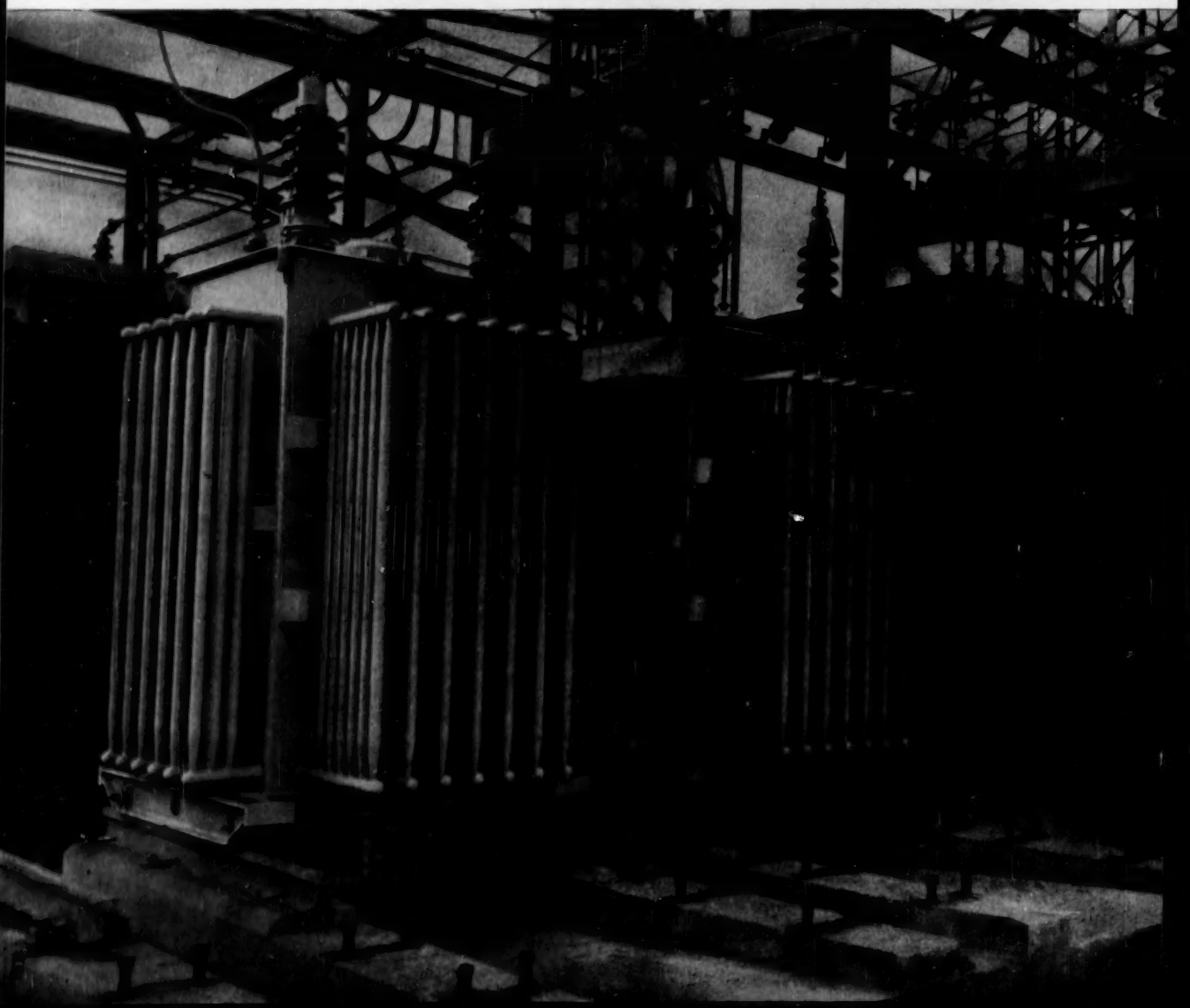
Call Westinghouse early to . . .

coordinate equipment for low cost, power dependability

Early planning of your power distribution system is the only effective way to answer these basic questions:

1. **How can I get the most reliability for dollars spent?**
2. **Will my electrical system be adaptable to changing load conditions with minimum service interruptions?**
3. **Can I get good voltage regulation in spite of load fluctuations?**

1. Standardized type SL transformers — liquid filled substation transformers for chemical use offer the many economies of Westinghouse standardization and design advantages based on years of tested and proved experience.



The choice of types of equipment and power distribution layout will depend on the problems in your plant . . . change-over, expansion, modernization, new processes or products. Westinghouse can help you select the right equipment and coordinate it to bring out the specific advantages that best suit your requirements.

Here are brief descriptions of the advantages you'll find in Westinghouse apparatus for a proven distribution system. They suggest many ways to provide maximum reliability without the expense of standby facilities.

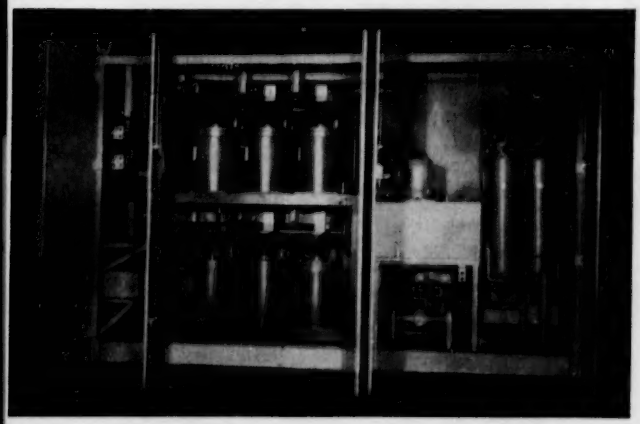
Discuss your plans with your Westinghouse Sales Engineer, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

MP-3054

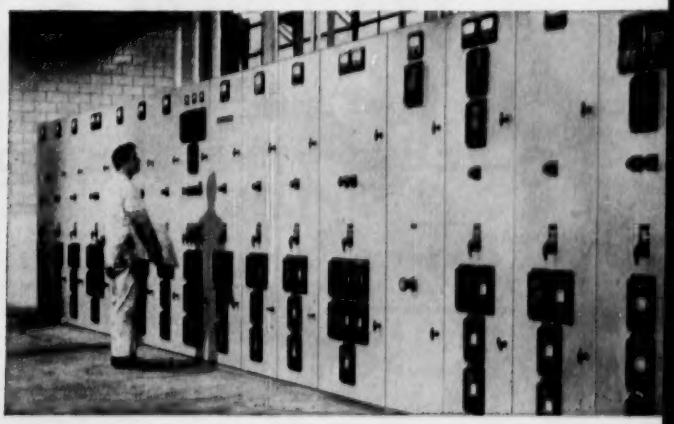
YOU CAN BE SURE...IF IT'S Westinghouse



2. Westinghouse oil circuit breakers with automatic reclosing equipment can automatically restore service to protect incoming lines or feeder circuits from prolonged and costly outages.

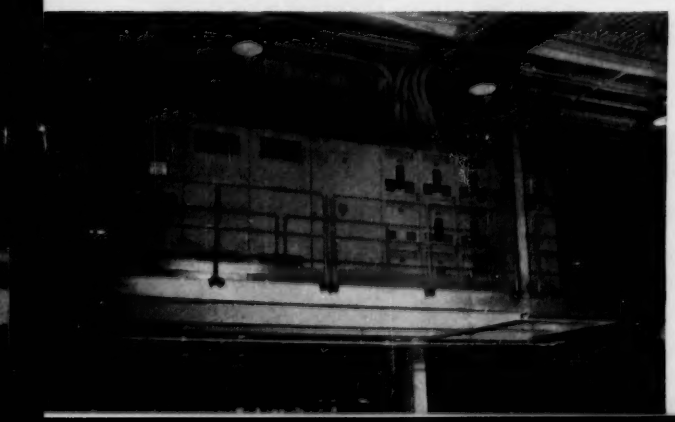


3. High availability and low maintenance of Westinghouse Ignitron Rectifiers has resulted in electrochemical installations totaling millions of kilowatts. Units are completely metal enclosed and factory assembled for low installation cost, minimum floor space.

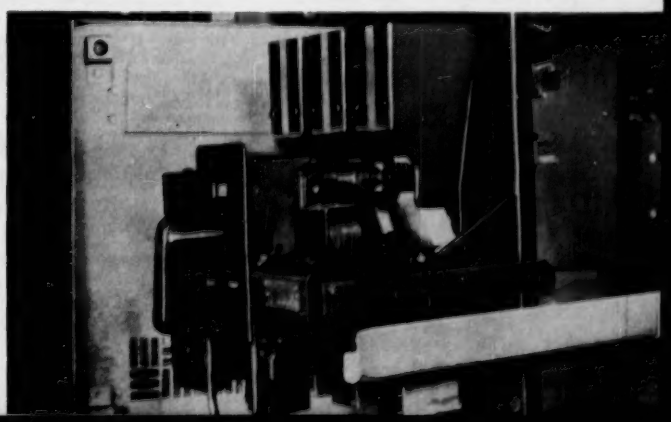


4. Westinghouse Metal-Clad High Voltage Switchgear provides unusual safety through interlocking devices and full steel barriers in a completely compartmentalized design.

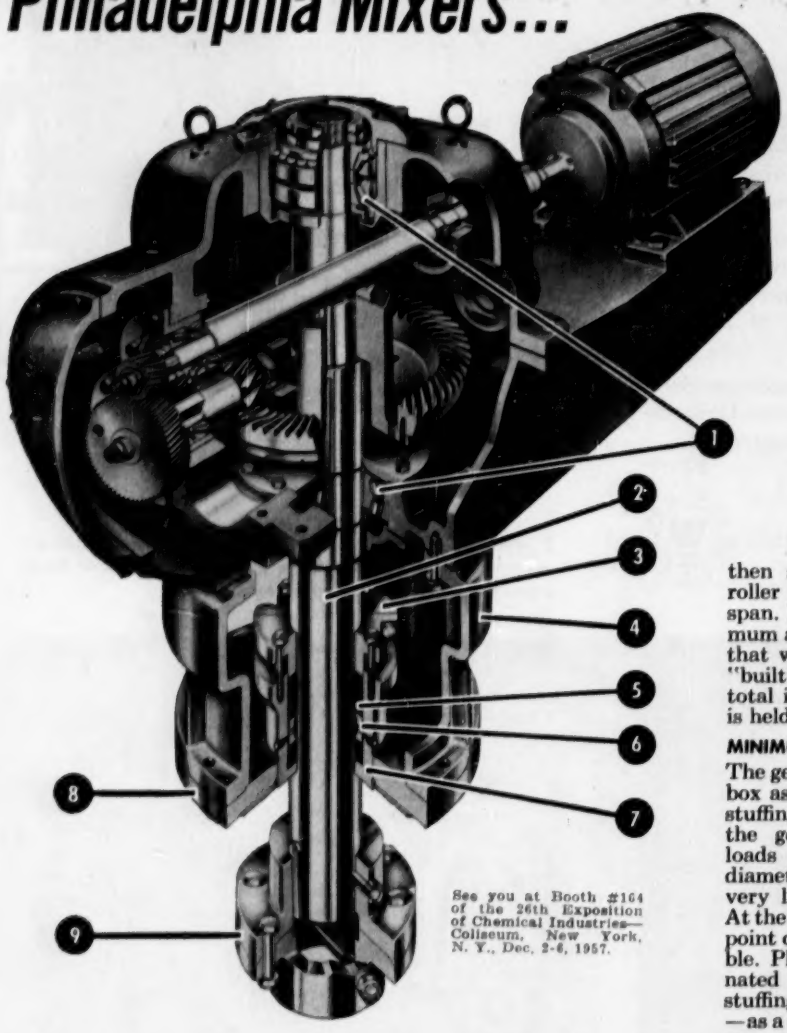
5. Westinghouse unitized dry-type power centers solve the problem of handling increased power loads economically. They cost less to install because they do not require expensive enclosures and can be located close to the center of the load. For expansion, install additional breakers in spare feeder compartments.



6. Westinghouse low-voltage switchgear design provides an unusual degree of flexibility. This results from modern selective tripping. You get perfect coordination of time-delay characteristics, which confines outages to the faulted section alone.



Philadelphia Mixers...



See you at Booth #164 of the 26th Exposition of Chemical Industries—Coliseum, New York, N. Y., Dec. 2-6, 1957.

1. Generously sized bearings positioned with maximum span provide shaft operation of best precision.
2. Extremely rigid, large diameter, polished shafting deflects minimum amount under operating conditions. Ideal conditions are provided for best stuffing box life, lowest maintenance cost.
3. Gland follower designed for easy adjustment. Split feature makes it easy to repack stuffing box.
4. Rigid cast stand assures precision alignment of output shaft through stuffing box by means of rabbet fits to gear reducer base and mixer mounting flange. Stand design makes it easy to reach stuffing box gland for adjustment.
5. Standard square packing—readily available.
6. Lantern ring, with two lubrication fittings at 180°, provides opportunity for best stuffing box lubrication. Tapped lifting holes make removal easy.
7. Stuffing box hub, flange facing, mixer drive output shaft, and mixer coupling supplied in any machinable alloy required to suit process conditions.
8. Mounting flange provided to mate with ASA standard and other flange sizes.
9. Philadelphia Mixer coupling saves you field assembly cost by enabling us to completely assemble and test the drive unit at our plant. You simply bolt the mounting flange to your tank flange, then couple the lower agitator staff.

guarantee low cost, trouble-free stuffing box operation

Philadelphia Model PTS Mixers are designed and built with this principle in mind: *a stuffing box operates best on a shaft that runs best.* Every effort is exerted to provide each drive with a mixer shaft that runs absolutely true. As a result, Philadelphia Mixers guarantee top stuffing box performance with minimum maintenance . . . least downtime.

LESS SHAFT RUNOUT . . .

On each Philadelphia Mixer, great care is taken to hold shaft runout to a minimum. Output shafts are precisely machined, ground, and polished to smooth concentricity, then supported by large, high capacity roller bearings mounted with generous span. Bearing clearances are held to minimum allowable limits. The result is a shaft that will operate with absolute minimum "built-in" runout. Even in biggest units, total indicated runout at the stuffing box is held to as little as 0.002".

MINIMUM DEFLECTION . . . LESS MAINTENANCE

The gear reducer support stand and stuffing box assembly are designed to position the stuffing box just as close as possible beneath the gear reducer bearings. Unbalanced loads applied to extremely rigid, large diameter shafts by mixing impellers cause very little shaft deflection at any point. At the stuffing box, positioned so near to the point of shaft support, deflection is negligible. Philadelphia Mixer design has eliminated the need of shaft support from the stuffing box, and it can function as intended —as a shaft seal only! Operate at high tank pressures with extremely long overhung shafts . . . and still be assured of trouble-free operation with minimum maintenance.

WIDE RANGE OF PRESSURES AND TEMPERATURES . . .

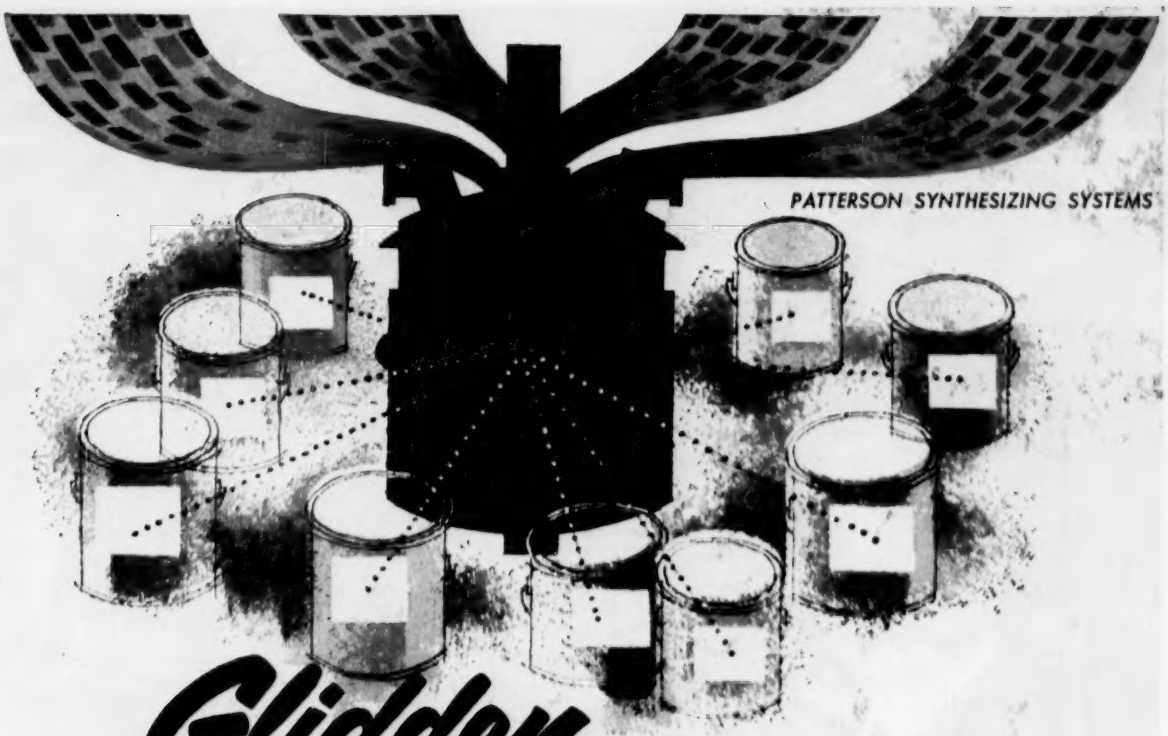
The standard stuffing box shown is designed to operate with vessel pressures ranging from full vacuum to 150 psig, temperatures to 500°F and above—depending upon effective range of packing type required for process conditions. Cooled stuffing boxes are supplied where needed. Standard PTS assemblies are supplied mounted upon ASA 150 lb. standard raised face flanges. Flanges of other dimensions, or rated for higher pressures, can be supplied.

For further details, write, wire or phone your nearest Philadelphia Mixer representative.

philadelphia mixers

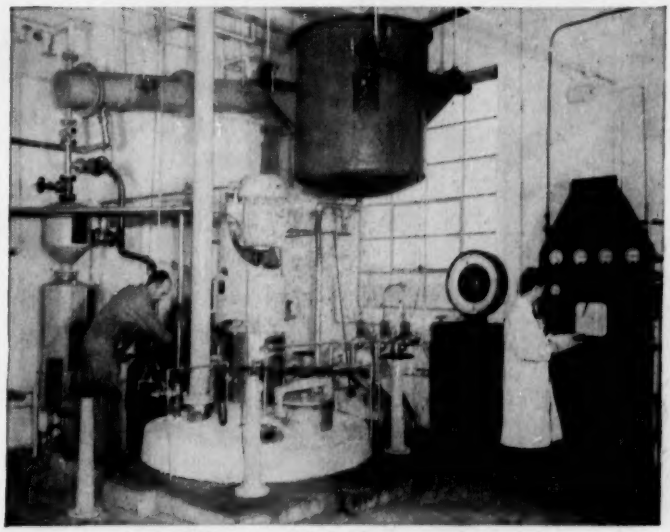
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Glidden COMPANY OF CANADA

IMPROVES COLOR QUALITY 50%



with Patterson RESIN SYSTEM

The problem of modifying alkyd resins to exact product specifications was solved for Glidden Company of Canada with the installation of a Patterson Resin System. Now, by producing their own resins to product formulations, Glidden gains a *50% improvement in color* of the finished solution while substantially reducing production costs. Excellent control of batch temperatures coupled with good quality control assures a high standard of batch-to-batch uniformity at Glidden.

Are there equally dramatic benefits to be gained by producing resins in your plant? A Patterson engineer will gladly analyze the possibilities without obligation to you. Write us or call the nearest Patterson Sales Office.

ADVANCED PROCESS EQUIPMENT OF ENDURING SATISFACTION

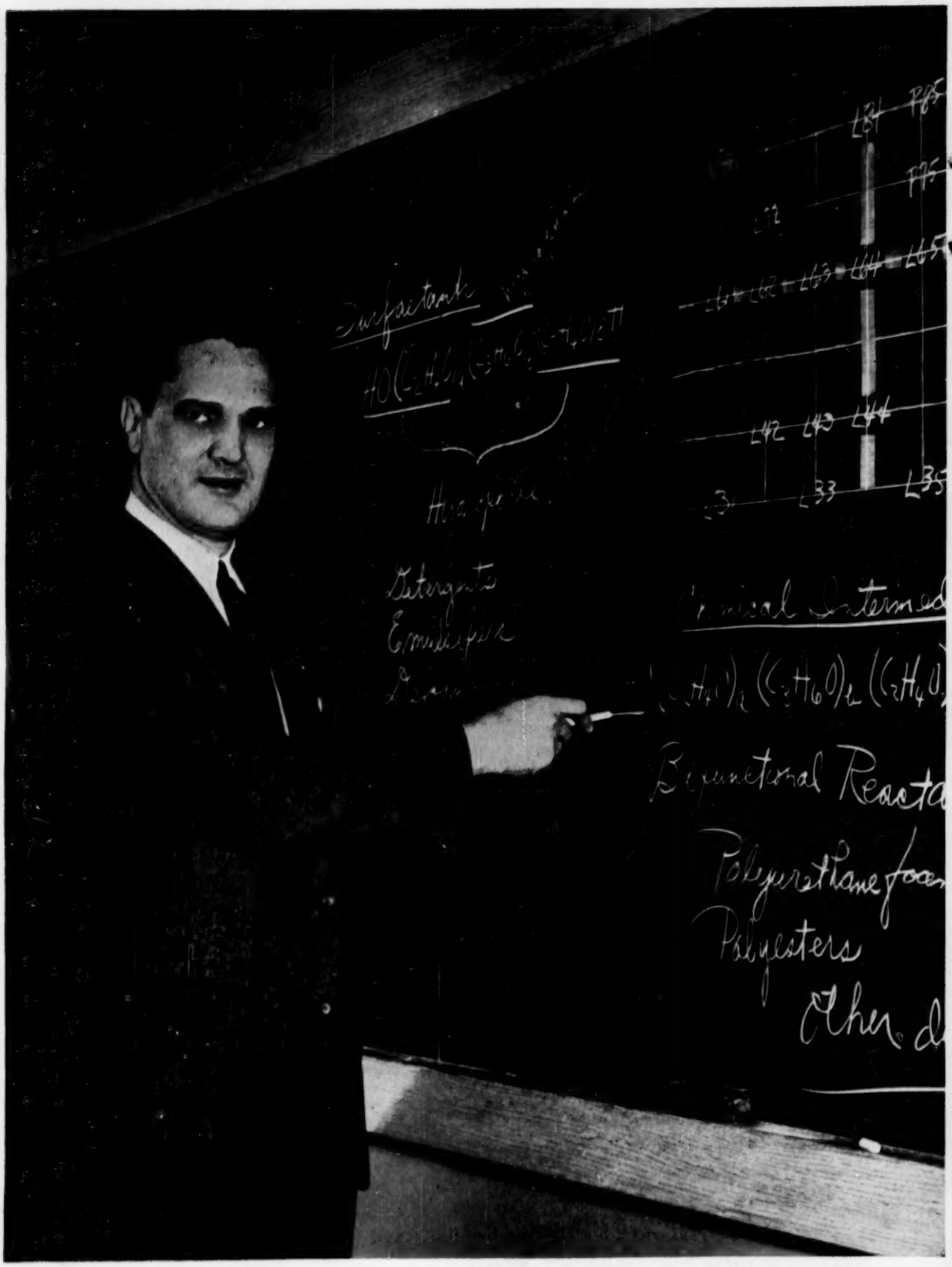
THE Patterson FOUNDRY AND MACHINE COMPANY

A Subsidiary of Ferro Corporation

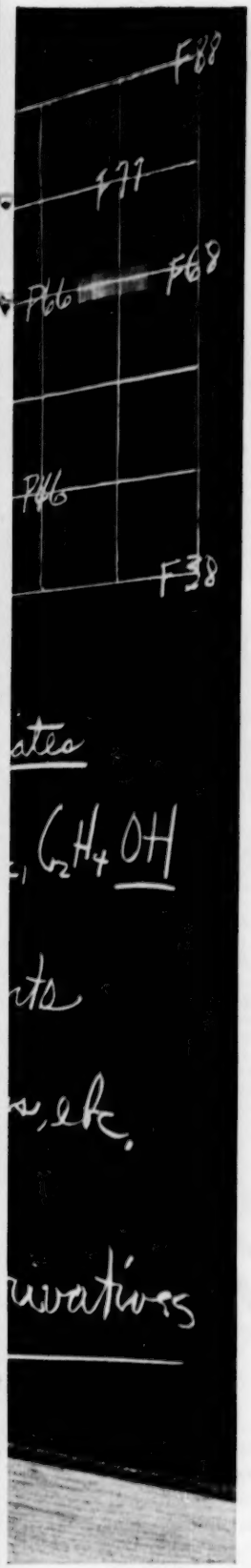
East Liverpool, Ohio

THE Patterson FOUNDRY AND MACHINE COMPANY (CANADA) LIMITED

Toronto, Ontario



WYANDOTTE CHEMICALS CORPORATION, WYANDOTTE,



"ONLY A THOROUGH EVALUATION CAN GIVE YOU THE FULL SCOPE OF WHAT THE PLURONIC BLOCK-POLYMERS CAN DO FOR YOU"

—reports Dr. J. William Zabor, Wyandotte Director of Research

"If any PLURONIC® were an ordinary surfactant, it would be a relatively simple matter for us to tell you how it would compare with what you are using. But the PLURONICS are not. They constitute a series of new and different chemicals—the first commercial examples of a block-polymer. And the PLURONICS are 100% active in *all* forms: liquids of varying viscosities, pastes, flakes, powders, and cast solids.

"Each PLURONIC is one of a series. The simplified structure may be expressed as:

$$HO(C_2H_4O)_a(C_3H_6O)_b(C_2H_4O)_cH$$

"As may be seen, the system presented here has the outstanding advantage of inherent flexibility. The total molecular weight of the hydrophobic base and the hydrophilic portion can be varied in small increments over the wide range of 1,000 to 11,000. It is therefore possible to prepare a product to meet almost any requirement of molecular weight or of hydrophobic-hydrophilic balance. When studying the PLURONICS' chemical possibilities, they may be recognized as polyols or difunctional polyethers.

"In considering the PLURONICS' surface-active properties, it is easy to evaluate the various grades with our Grid. You can do it by pencil-o-metric* research, for the PLURONICS are plotted on the Grid by molecular weight, and hydrophobic-hydrophilic ratio. By observing the property trends shown on the Grid, you can concentrate on those PLURONIC grades which offer the most promise for you. The Grid does away with random evaluation of unrelated surfactants . . . makes it possible for you to predict the characteristics you can get with a PLURONIC or a combination of the PLURONICS in a formulation; thereby the performance of the product itself may be predetermined.

"If you do not have a PLURONIC Grid, write for your copy today. If you do have one, remember: recent additions to the PLURONIC series . . . important new application developments . . . make it advantageous for you to keep in touch with us. Samples are, of course, available upon request for your evaluation.

"With the PLURONICS, you may develop a product that is new, different, exclusive (with you), and highly profitable. Remember, they have found application in many varied fields already, including cosmetics, formulated detergents, paint, petroleum, plasticizing, and water treating, to name a few. You have many things to gain in giving the PLURONICS consideration."

**Pencil-o-metric evaluation is the ability to predetermine the performance of a raw-material chemical in a formulation or process prior to actual laboratory study.*

MICHIGAN ALKALI DIVISION

Wyandotte Chemicals

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CHLORINE • MURIATIC ACID • CALCIUM CARBONATE • CALCIUM CHLORIDE • GLYCOLS • CHLORINATED SOLVENTS • SYNTHETIC DETERGENTS
OTHER ORGANIC AND INORGANIC CHEMICALS

MICHIGAN • OFFICES IN PRINCIPAL CITIES

Mechanical instruments for

TEMPERATURE

PRESSURE

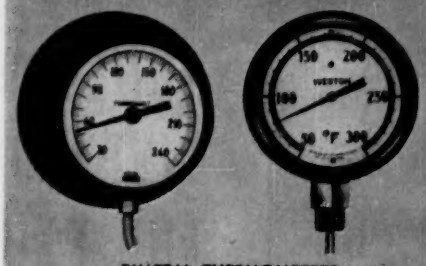
VACUUM

HUMIDITY

LIQUID LEVEL

PNEUMATIC RECEIVING

INDICATING



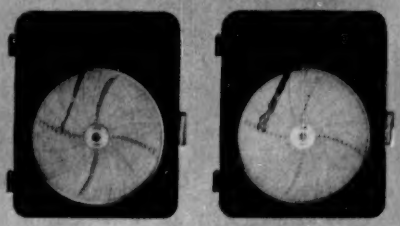
BIMETAL THERMOMETERS

Exclusive multiple helix bimetal elements. Exceptional rigidity and fast, dependable thermal response. Available in straight and angle forms . . . head dias. from 2" to 5" . . . ranges from −100 F to high as +1000 F . . . stainless steel stems from 2½" to 24".

FILLED SYSTEM THERMOMETERS

Liquid-, vapor-, gas-, or mercury-filled. Dial-indicating. Fixed stem or distant reading types. Accurate compensations. With or without electric contact feature.

RECORDING



TEMPERATURE AND/OR PRESSURE . . . HUMIDITY . . . PNEUMATIC RECEIVING

1 to 4 pens. Multi-pen instruments allow each pen the full range of the chart — or limit each pen to its own zone — as desired. Each system operates independently. Safety links prevent damage when moving elements exceed established ranges. Precalibrated systems need be checked at only one point. Standard zoned charts available for instruments combining two different types of data.

Weston supplies

Looking for the right mechanical instrument? No need to compromise in any particular! You'll find *exactly* what you need within the complete WESTON line . . . one that will fill your requirements efficiently, and most economically. And you'll get the advanced design, rugged construction, and the dependability that have kept Weston the leader in precise instrumentation for close to three quarters of a century. For complete information on any of these mechanical instruments, contact the Weston representative in your vicinity, or write, Weston Electrical Instrument Corp., 617 Frelinghuysen Avenue, Newark 5, N. J.

ALL PNEUMATIC CONTROL FORMS



NON-INDICATING CONTROLLERS . . .
temperature or pressure

Pneumatic controllers of the "High Sensitivity" type with approximately a 5% throttling range. The air relay is a simple trouble-free ball-valve type operated directly from the measuring element. Can incorporate electrically driven cams to provide time cycle control.



RECORDING CONTROLLERS . . .
temperature or pressure
pneumatic receiving
temperature-humidity

Narrow and full range throttling, automatic reset and quick response control forms.



PROGRAM RECORDING CONTROLLERS . . .
temperature or pressure

Variable control according to predetermined time schedule, as established by contour of cam mounted on chart.



INDICATING CONTROLLERS . . .
temperature or pressure

Single, duplex, and double system models. Full-range control settings; all control forms. Standard temperature ranges up to 800°F. Pressure ranges up to 7500 psi or 150 mm of mercury vacuum.

liquid level — Bubbler-type elements.



TIME CONTROLLERS . . .
temperature or pressure

Standard instrument which can be adjusted to provide different rates of rise, and durations of the hold period. Holding temperature or pressure can be changed to any point within the range of the instrument.



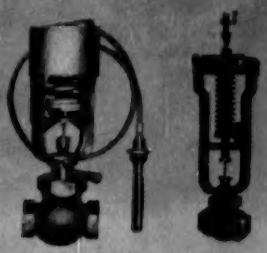
'FAULTLESS' CONTROLLER
. . . temperature

Apparatus-mounted. Suitable for operation between—40° and 700°F. Dependable expansion-stem type. Operates on 18 psi air supply. Direct and reverse acting types.



'SIMPLEX' CONTROLLER
. . . pressure

Apparatus-mounted, or used remotely. Pressure is transmitted to controller, which positions the air valve, regulating pressure to the top of the diaphragm valve. Operates on 18 psi air supply.



SELF-OPERATING CONTROLLERS . . .
temperature or pressure

Self-contained instruments requiring neither compressed air nor electricity; employing only the power developed within their own systems. Valve sizes ½" to 2". All required ranges.

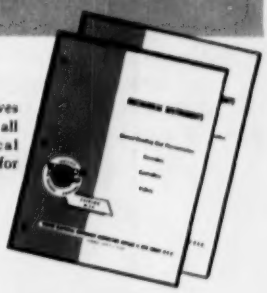


DIAPHRAGM MOTOR VALVES

Valves for all kinds of control systems. Direct, reverse acting, and three-way types.

them all

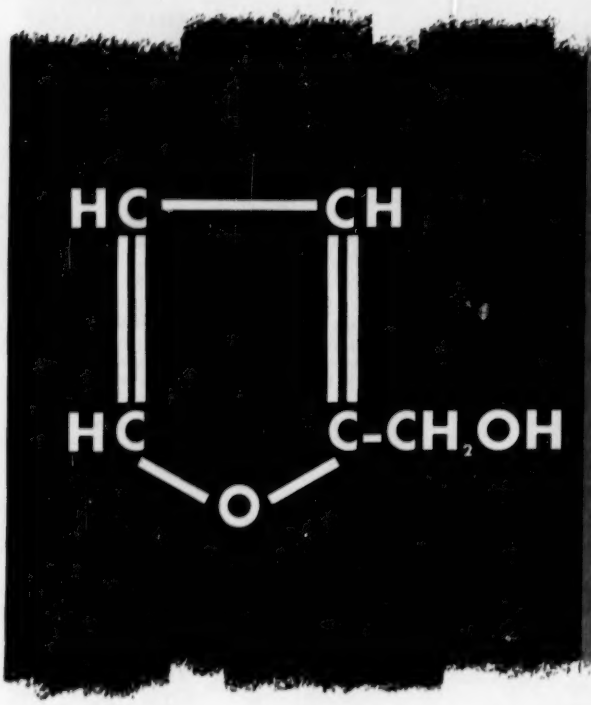
Catalog M-2-C gives complete data on all Weston Mechanical Instruments. Write for copy to-day.

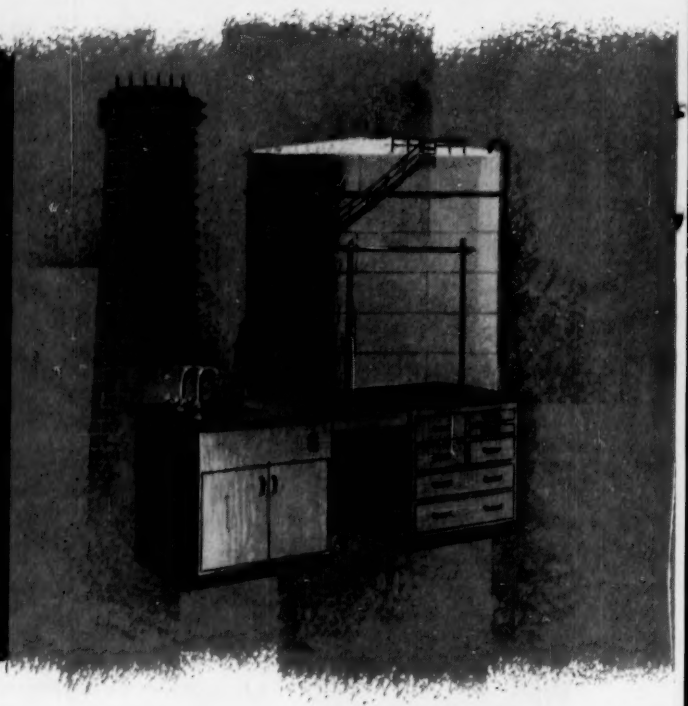


WESTON *Instruments*

A DAYSTROM UNIT

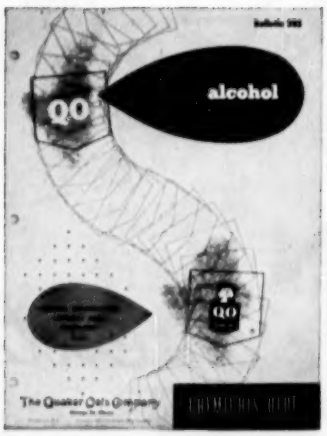
A Quaker Oats Company Use Report





RESINIFIES TO FORM CORROSION RESISTANT RESINS:

Resins prepared from furfuryl alcohol are resistant to attack by acids, alkalies, and organic liquids. In addition, these resins have high heat resistance and low porosity. More and more industries are using furfuryl alcohol resin mortars in the construction of floors, pickling tanks, sewers, smokestacks, digesters and reactors. Furfuryl alcohol based resins also serve as binders for glass fabric or asbestos reinforced pipe and duct, and in reinforced tanks and laboratory table tops.



For information on physical data, chemistry, and uses, write for Bulletin 205.

on QO® Furfuryl Alcohol (FA®)



DISSOLVES AND REACTS WITH MANY RESINS:

Highly active, yet easily controlled, furfuryl alcohol both dissolves and reacts with phenolic resins. As such, FA becomes an integral part of the final bond. It assures good curing and easier manufacture of hard resinoid grinding wheels and other abrasives.

IMPROVES GAP-FILLING AND CRAZE RESISTANCE PROPERTIES OF UREA ADHESIVES:

QO Furfuryl alcohol modified urea resins form gap-filling glues of exceptional strength. Such adhesives are flexible, resist cracking and deterioration upon aging. They reduce shrinkage and assure an enduring bond under many conditions of pressure, temperature and glue line thickness. Typical applications of the adhesive include lumber core gluing, edge bonding, furniture manufacture, and other wood to wood gluing applications where the joints rarely are uniformly matched.

The Quaker Oats Company does not manufacture furfuryl alcohol resins, but is glad to put you in touch with suppliers.

The Quaker Oats Company
CHEMICALS DEPARTMENT

The Quaker Oats Company — CHEMICALS — QO QUAKER CHEMICALS — DEPARTMENT

335U The Merchandise Mart,
Chicago 54, Illinois

Room 535U, 120 Wall St.,
New York 5, N. Y.

Room 435U, 48 S.E. Hawthorne Blvd.
Portland 14, Oregon

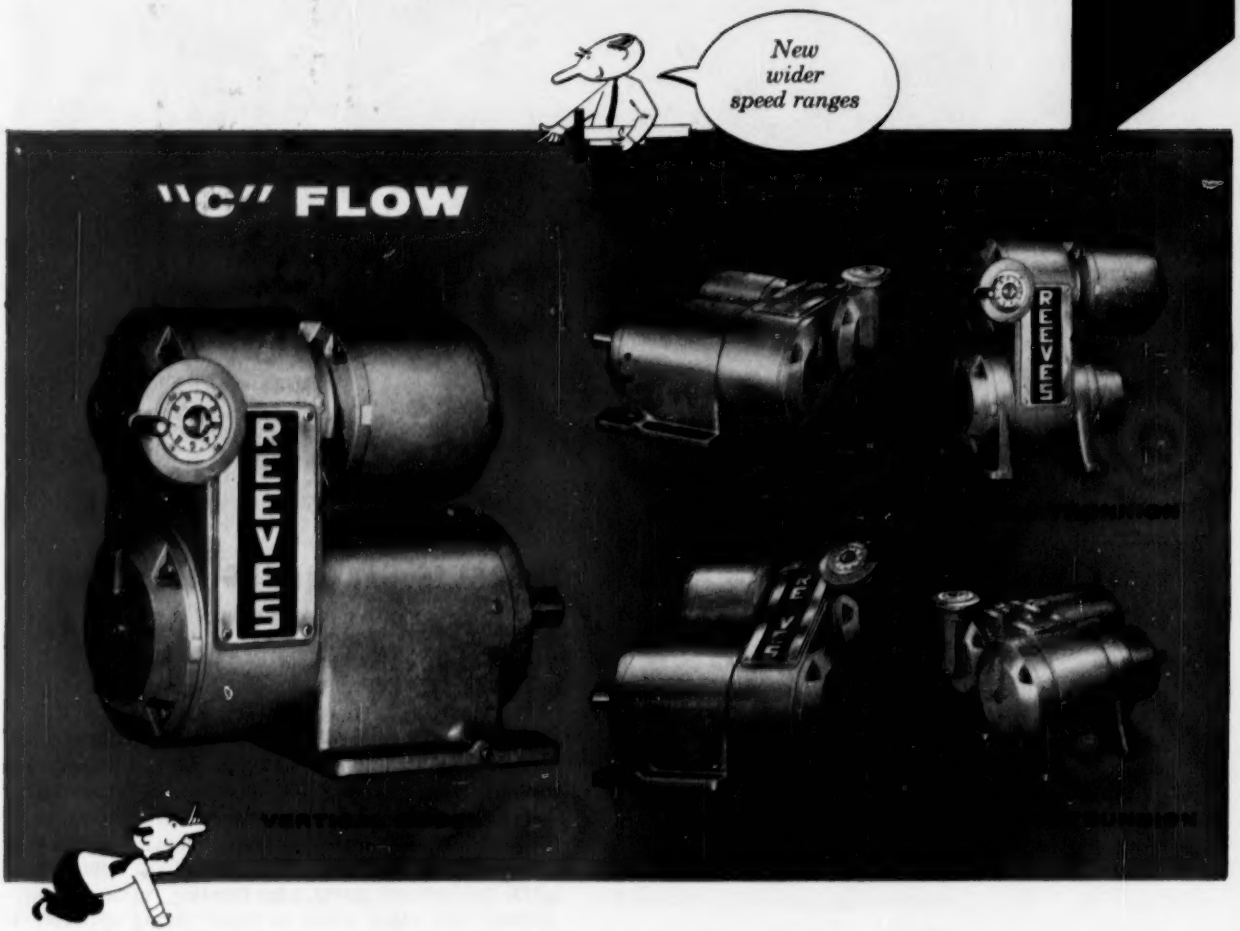
In the United Kingdom:
Imperial Chemical Industries, Ltd., Billingham, England

In Europe:
Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands;
Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France;
A/S "Ota", Copenhagen, S. Denmark

In Australia:
Swift & Company, Ltd., Sydney

In Japan:
F. Kanematsu & Company, Ltd., Tokyo

variable speed with new versatility and performance



A triumph of new Motodrive design . . . inside and out

New REEVES Vari-Speed Motodrives, sizes 200 and 300, are complete variable speed power packages, built with compactness and precision, to give improved performance on installations 1 through 5 hp.

The new sizes are designed in two styles—"C" flow and "Z" flow. In each style, there are several different models and reducers with increased capacity in single, double or triple stages.

The flexible design permits hundreds of combinations . . . space-saving, space-fitting *standard* assemblies to meet most installation requirements.

The handwheel control location can be rotated to optional positions for greater operating convenience; extra precision of control is available with the addition of one or more REEVES accessories or modifications.

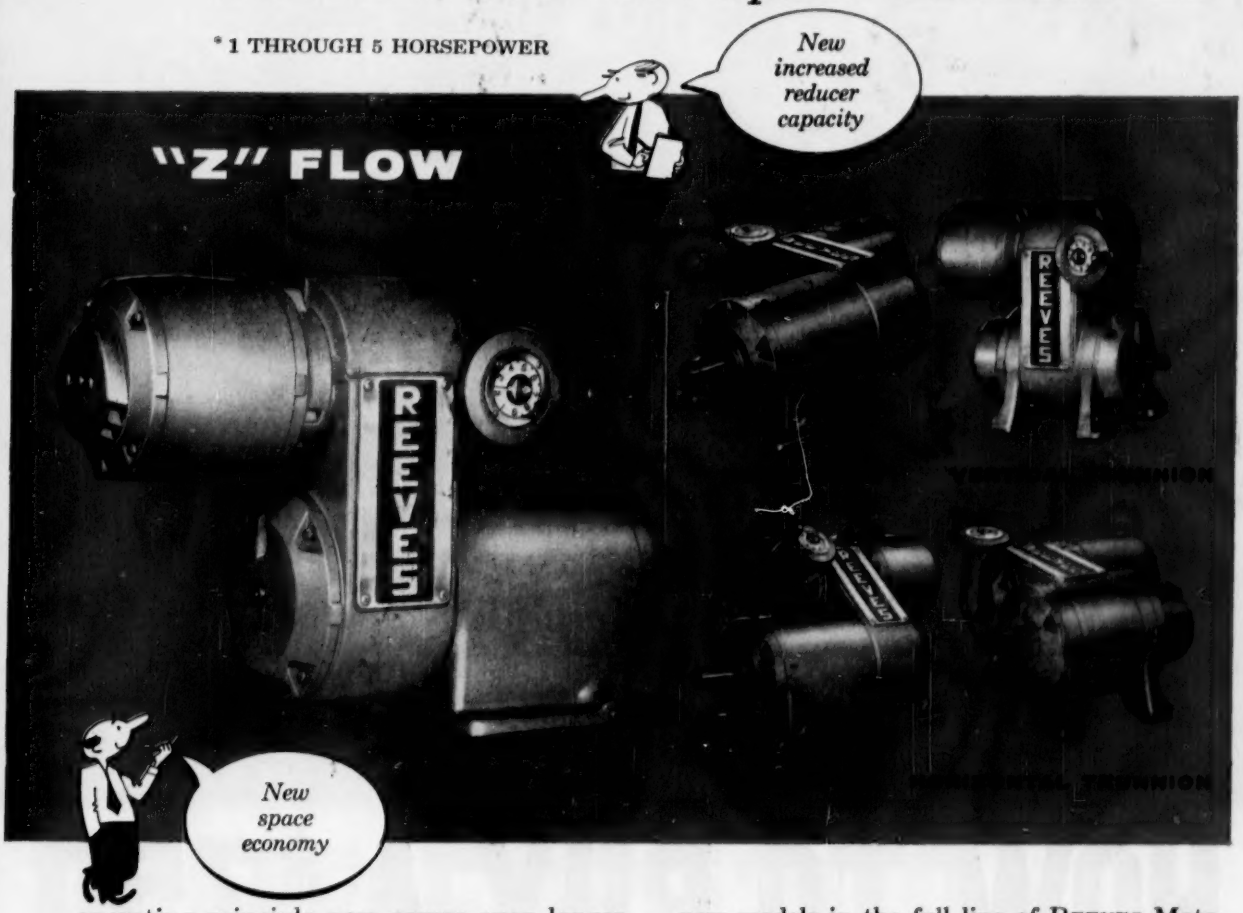
Refinements to the time-tested REEVES

NEW

REEVES®

*Sizes 200-300 Vari-Speed MOTODRIVES**

* 1 THROUGH 5 HORSEPOWER



operating principle now assure even longer trouble-free service.

New disc assemblies permit wider output speed ranges . . . discs are pre-aligned . . . pre-loaded spring maintains correct belt tension for longer belt wear . . . *exclusive* "close-grooving" lubrication assures free sliding discs . . . new Metermatic system automatically lubricates the motor and variable shaft bearings.

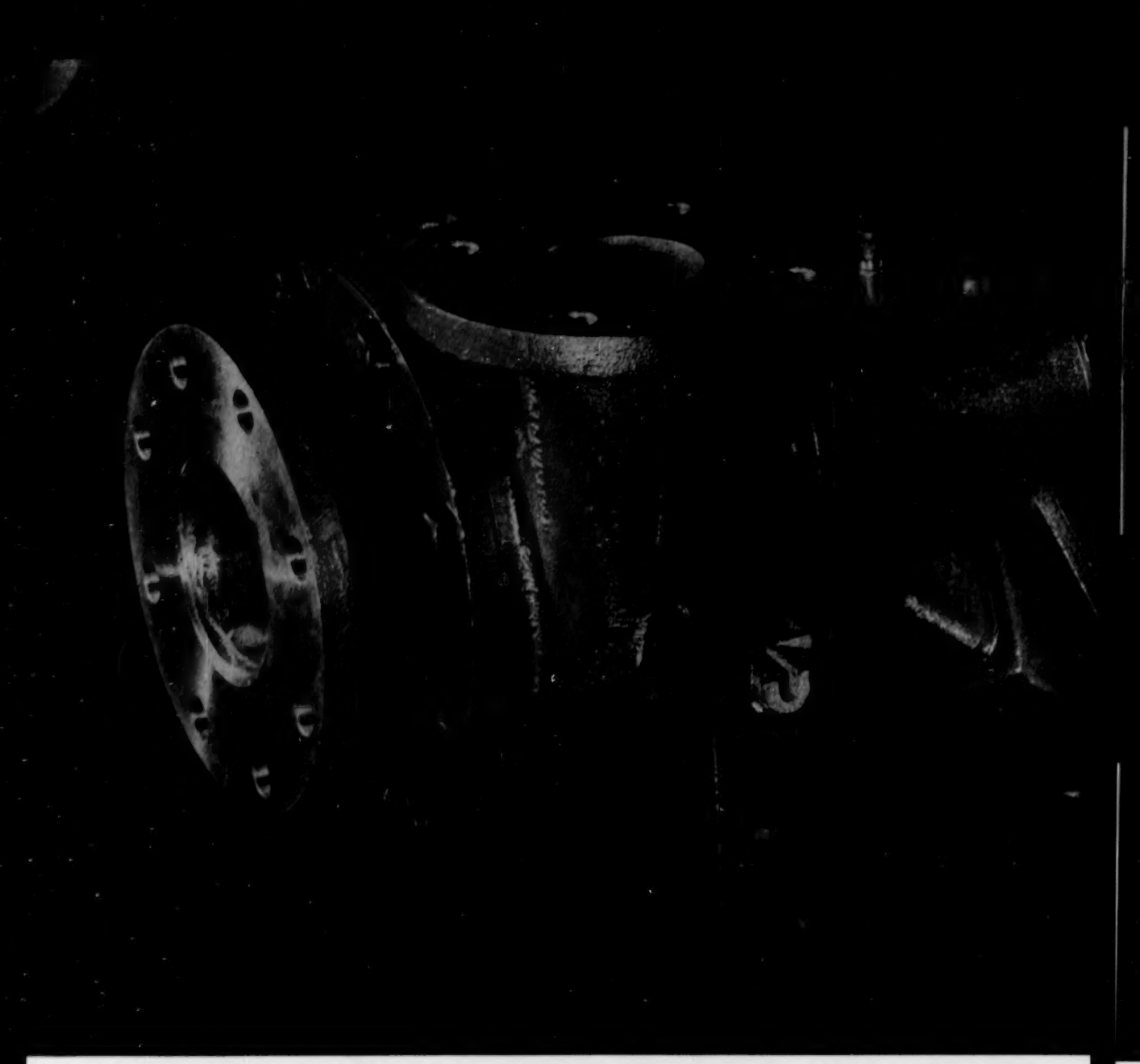
Sizes 200 and 300 are versatile, hard-working new models in the full line of REEVES Motodrives which provide instant and accurate variable speed control on ¼ through 40 hp. applications.

Complete details, dimensions, illustrations and prices on assemblies, modifications and accessories are in Catalog CE31a-M571. Write for your free copy today.

REEVES PULLEY COMPANY

Division of **RELIANCE** ELECTRIC AND ENGINEERING CO.

Columbus, Indiana



HOW TO BUY A $750

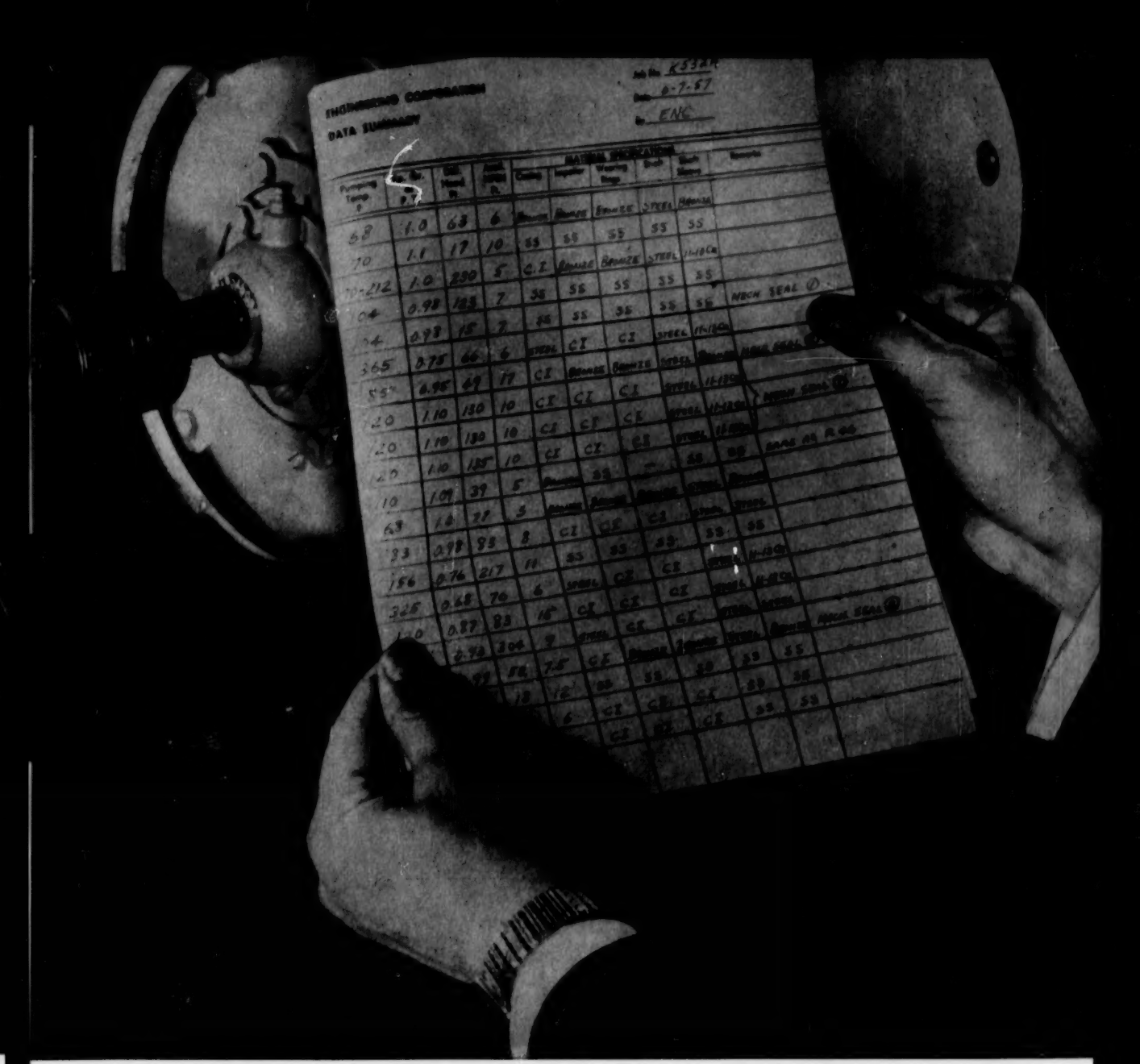
When you need a "special" pump, Worthington's SESC (Standard End Suction Centrifugal) line will often prove the low-cost answer.

For example, the chart above shows specifications for 21 different pumps, with a variety of materials of construction, which would ordinarily involve manufacture of special pumps. However, because all of these materials are available from the SESC line, the pumps can be bought at big savings.

The secret of Worthington's ability to give you many normally special pumps at standard prices is the flexibility of the SESC line. *Parts* have been standardized, but not *pumps*. As a result, you can literally "custom-build" your pump to get exactly the right features to meet your requirements.

70,480 COMBINATIONS TO CHOOSE FROM. You have a choice, for example, of four materials of construction—iron, steel, bronze, Worthite* and combinations of these. You have a choice of five types of liquid ends and five different drives. You can choose packed stuffing box or mechanical seal operation. In all, there are 70,480 combinations—all built from standard, stocked parts and ready for prompt delivery at competitive prices.

*A high nickel, high-chromium, low-carbon alloy steel. Trademark Reg. U. S. Pat. Off.



PUMP FOR $300!

STANDARDIZATION PAYS OFF LATER. After you have installed an SESC pump, you benefit again from Worthington's broad standardization program. Since all pumps in the line are built from interchangeable parts, your spare parts inventory can be cut as much as 50%. Should repairs or conversions become necessary, parts interchangeability can often mean reduced downtime.

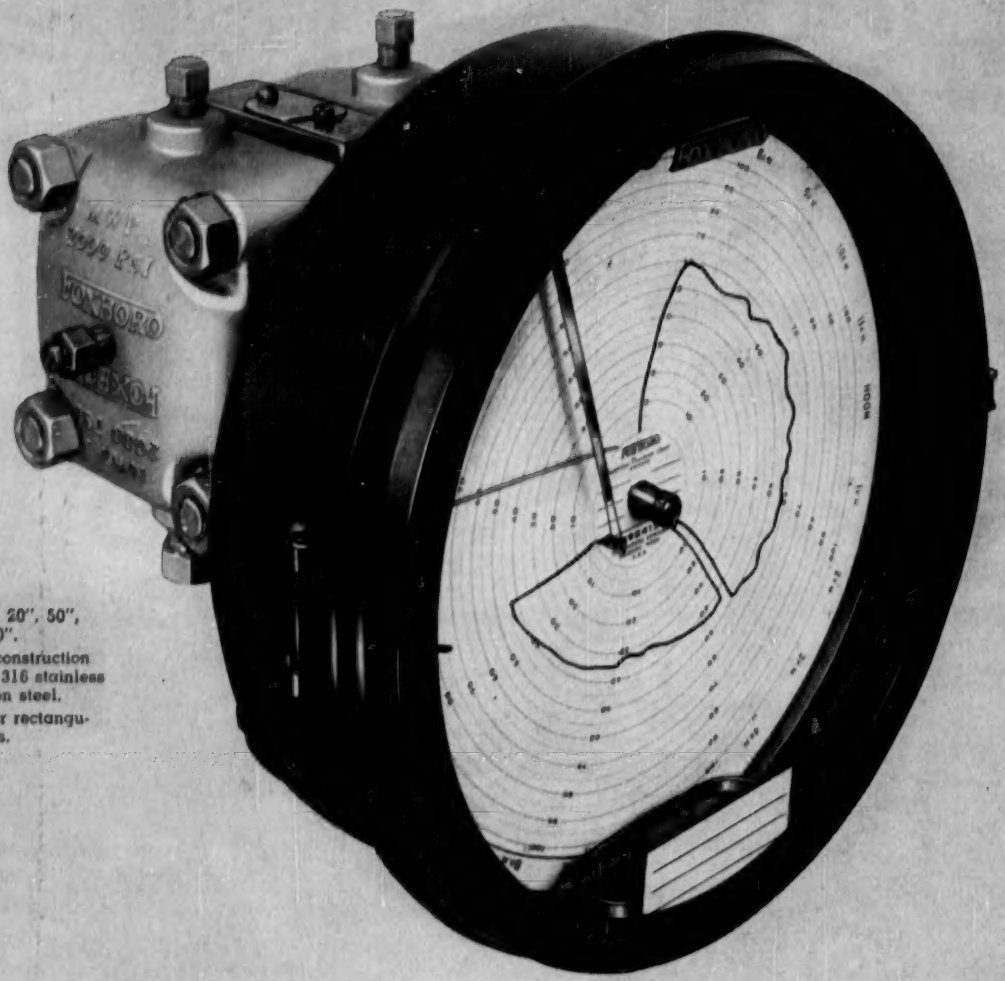
The complete SESC line consists of six separate types of pumps, all suitable for either motor, turbine or belt drive. Ratings range up to 2,700 GPM and 550 ft. head. If you'd like to know more, write for Bulletin W-300-B4. Worthington Corporation, Harrison, N. J.



CUTS MAINTENANCE
If you know one SESC pump, you know them all. From the smallest to the largest the entire line is built to the same basic design. Maintenance men quickly become familiar with its construction details.

WORTHINGTON

NOW... a "Dry" Flow Meter with..

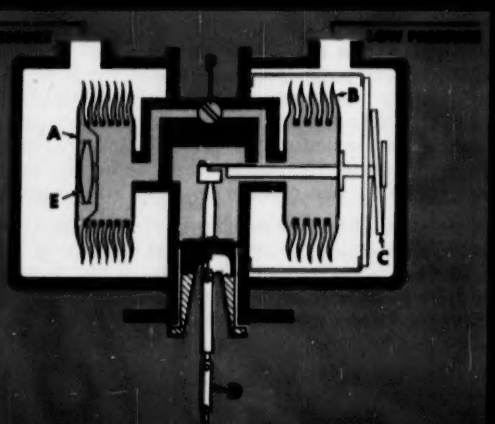


- Ranges: 20", 50", 100", 200".
- Forged construction in Type 316 stainless or carbon steel.
- Round or rectangular cases.

...the new Foxboro Type 37 Diaphragm Meter

How It Works

In schematic drawing at right, areas shown in color represent a stable, non-freezing liquid. Any pressure increase in the high pressure chamber compresses Diaphragm Unit A, displacing its liquid and expanding Diaphragm Unit B until force of Range Spring C equals the difference between the forces on Diaphragm Units A and B. Linear motion of Diaphragm Unit B moves inner end of Drive Bar D — outer end moves correspondingly through the bellows-sealed flexure bar, driving-pen arm. Built-in Temperature Compensator (E) proportionately adjusts diaphragm capacity as ambient temperature variations affect volume of filling fluid. External damping adjustment is shown at F.



• *complete overrange protection!*

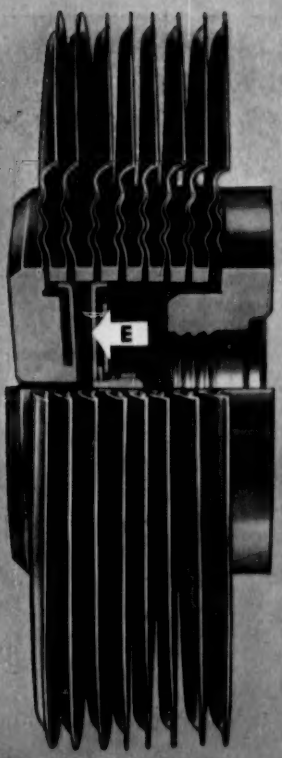
• *sustained high accuracy!*

Now you can have mercuryless flow measurement for a wide range of differential pressures — at static pressures up to 2000 psi — with greater safety and dependability than ever before! The new Foxboro Type 37 Diaphragm Meter not only combines unmatched ruggedness and precision in a dry meter — it's by far the easiest to adjust and maintain. And it does away with zero drift problems, once and for all! Expansible, Type 316 S.S. diaphragm elements respond to changes in pressure with unmatched sensitivity, yet are completely immune to overrange up to full static pressure! A unique packless drive bar precisely transmits linear motion to the pen arm. Range-changing is easy, due to new twin-spiral spring design. Wide range damping is externally adjustable under pressure. And the Type 37 is self-compensating for temperature changes in all differential ranges. Get full details on this high utility, completely dependable dry flow meter. Arrange for a demonstration with your nearby Foxboro Field Engineer, or write **The Foxboro Company, 1010 Norfolk St., Foxboro, Mass., U.S.A.**

FOXBORO

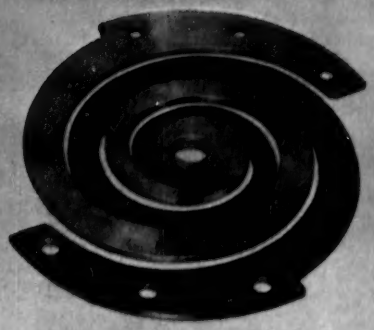
REG. U.S. PAT. OFF.

FIRST IN FLOW METERING



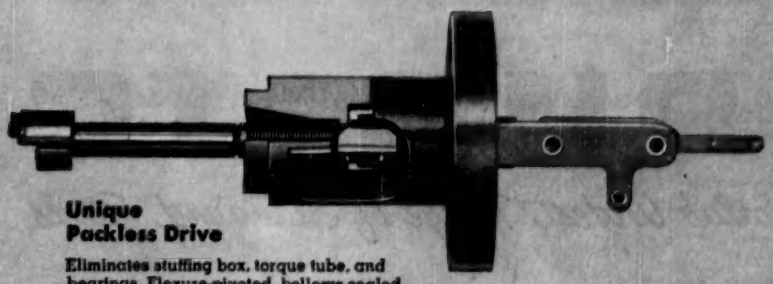
Exclusive Diaphragm Elements

Type 316 S.S. diaphragm units in both high and low pressure chambers provide greatest linearity and freedom from hysteresis; nesting design and integral spacer rings provide safe, positive, overrange protection. Temperature compensation (E) is built into diaphragm assembly . . . *never* requires change or adjustment.



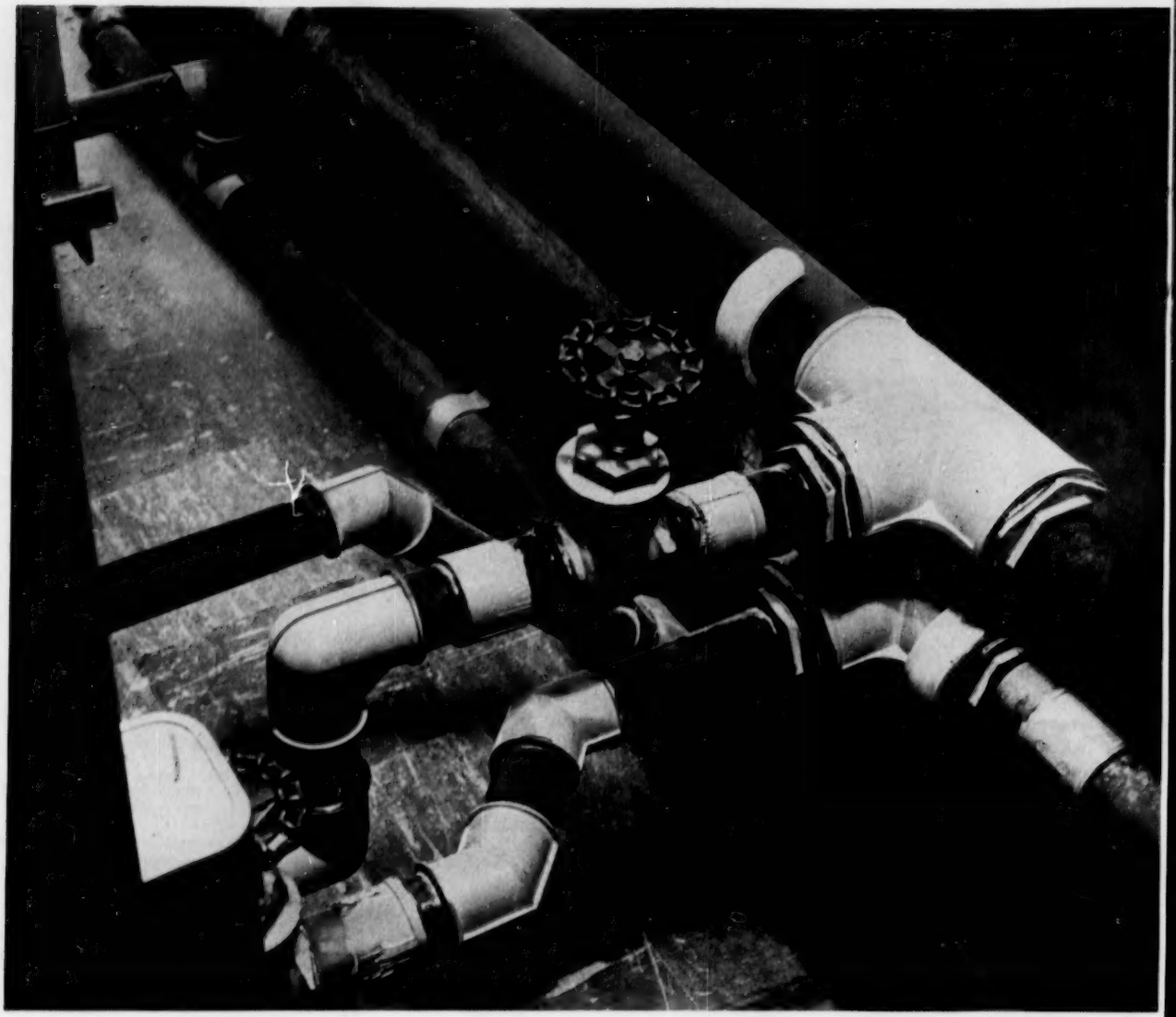
Exclusive Range Springs

Heavy gauge Ni-Span C alloy, twin-spiral springs provide high sensitivity with lasting accuracy. Readily accessible . . . range changes are easily made, in minutes!



Unique Packless Drive

Eliminates stuffing box, torque tube, and bearings. Flexure-pivoted, bellows-sealed drive bar transmits diaphragm's linear motion to the pen arm with unequalled sensitivity *and undiminished power.* Seal for flexure pivot is a tough, flexible bellows.





Republic SRK cuts easily with an ordinary handsaw or hacksaw. Joints are "welded" together with a brush-applied solvent and a sleeve-type fitting.

Once the solvent is applied, the pipe is stabbed into fitting and given a ⅛ turn. That's all there is to it—and the "weld" is permanent.



REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

TOUGH, LIGHTWEIGHT PLASTIC PIPE

solves re-piping problem at Blaw-Knox

Republic SRK was easier, safer, less costly to install... will resist corrosive liquids in cooling-tower installation

Corrosive liquids in the cooling towers of the Blaw-Knox Company of Pittsburgh, Pa., were raising havoc with the piping. Pipes lasted little more than a year before they had to be replaced. In an attempt to lick the problem, other pipe materials were tried. But initial costs proved too high. Then Blaw-Knox switched to Republic SRK—the amazing corrosion-resistant plastic pipe that practically eliminates replacement costs.

It's too early to check results, but based on past experience they are sure to be excellent. Republic SRK, installed in similar cooling-tower applications more than three years ago, is still good as new, showing absolutely no signs of damage or wear. And in every case there was a substantial savings—in material costs, installation costs, and, of course, replacement costs.

Within its temperature and pressure limitations, Republic SRK will prove ideal for many applications in the chemical and food processing industries—in both waste and process lines. It's highly resistant to a long list of corrosive liquids and gases. Being *extremely tough,* it will absorb terrific punishment.

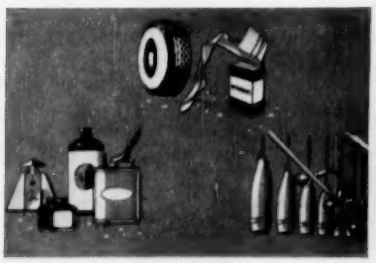
Republic SRK is light weight, easy to carry. It cuts quickly, is easily joined by simple solvent-welded sleeve-type fittings. This eliminates the fire hazard of a torch. And it's ideal to assemble where space is limited.

The latest manufacturing techniques, and highest standards of quality-control, result in wall sections of uniform strength throughout each length. Republic SRK comes in a range of working pressures—in sizes ½" through 6". Republic also supplies SRB (butyrate) and FE (polyethylene) Plastic Pipe. If you have a piping problem, write us. We can recommend the proper pipe for the job. Send coupon for literature.

REPUBLIC IS ALSO A BASIC PRODUCER OF MANY CHEMICALS DERIVED FROM COAL—benzols, toluols, xylols, sulphate of ammonia, tar, crude naphthalene, pyridine and crude heavy solvent. Like all Republic products, quality is controlled at every stage of production, from mine through coke oven, to final processing of the coal chemicals.

DISCOLORATION AND CONTAMINATION ARE NO PROBLEM when chemical products are transported through ELECTRUNITE® Stainless Steel Tubing and Pipe made by Republic's Steel and Tubes Division. ELECTRUNITE Stainless Steel Tubing and Pipe last years longer because they are corrosion-resistant, have a wide range of resistance to temperature, pressure, and physical damage.

SAVE CONDUIT-REPLACEMENT COSTS BY INSTALLING DEKORON®-COATED E.M.T. OR CONDUIT—the electrical raceway that shrugs off corrosion. A tough, polyethylene coating over the galvanized finish actually provides double protection for your wiring systems where the atmosphere is excessively corrosive. Moisture-tight, corrosion-protected joints are made by wrapping the connections with plastic tape. Send coupon for details.







STEEL

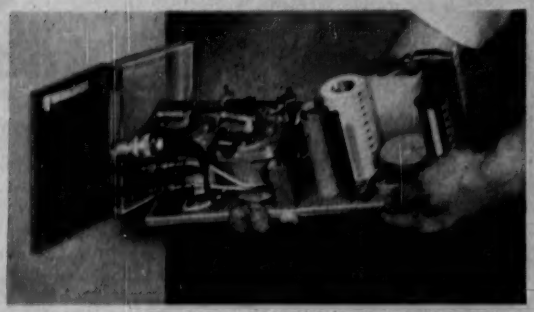
and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-3496-R
3116 East 45th Street, Cleveland 27, Ohio

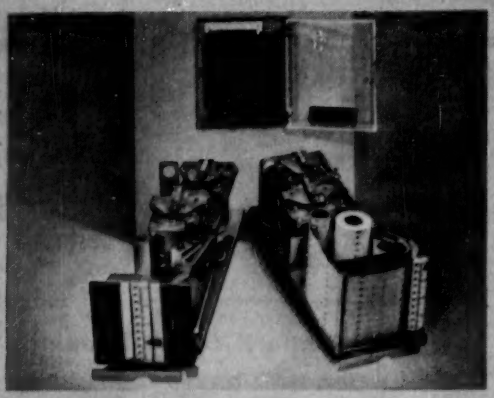
Please send me information on:

☐ SRK Plastic Pipe ☐ Coal Chemicals
☐ Republic ELECTRUNITE Stainless Steel Pipe and Tubing
☐ Dekoron-Coated E.M.T. and Rigid Steel Conduit

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

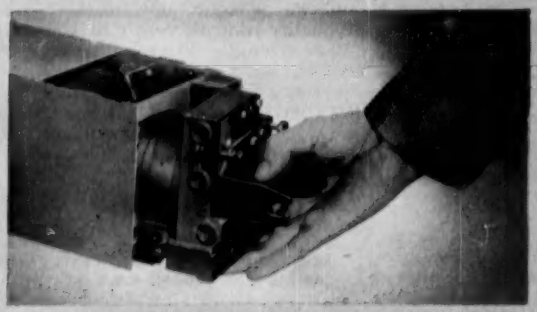


Easily Serviced—All parts can be inspected during operation, without process interruption. To remove chassis completely, unscrew three finger-tight, self-sealing connections.

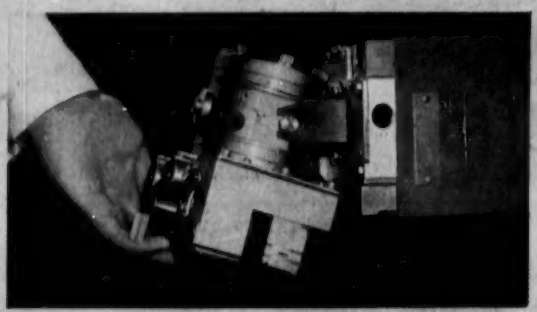


Interchangeable Chassis—Change recorder to indicator or vice versa without interrupting control. Simply pull out chassis, slide another in place.

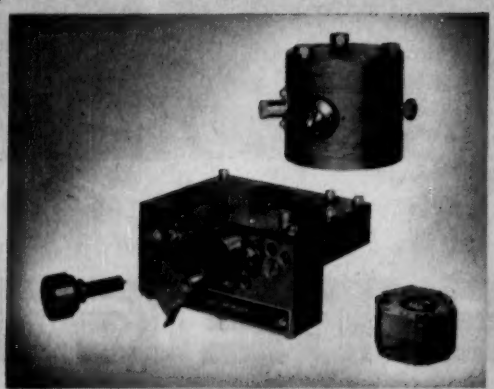
Now you can gain ... *Extra*



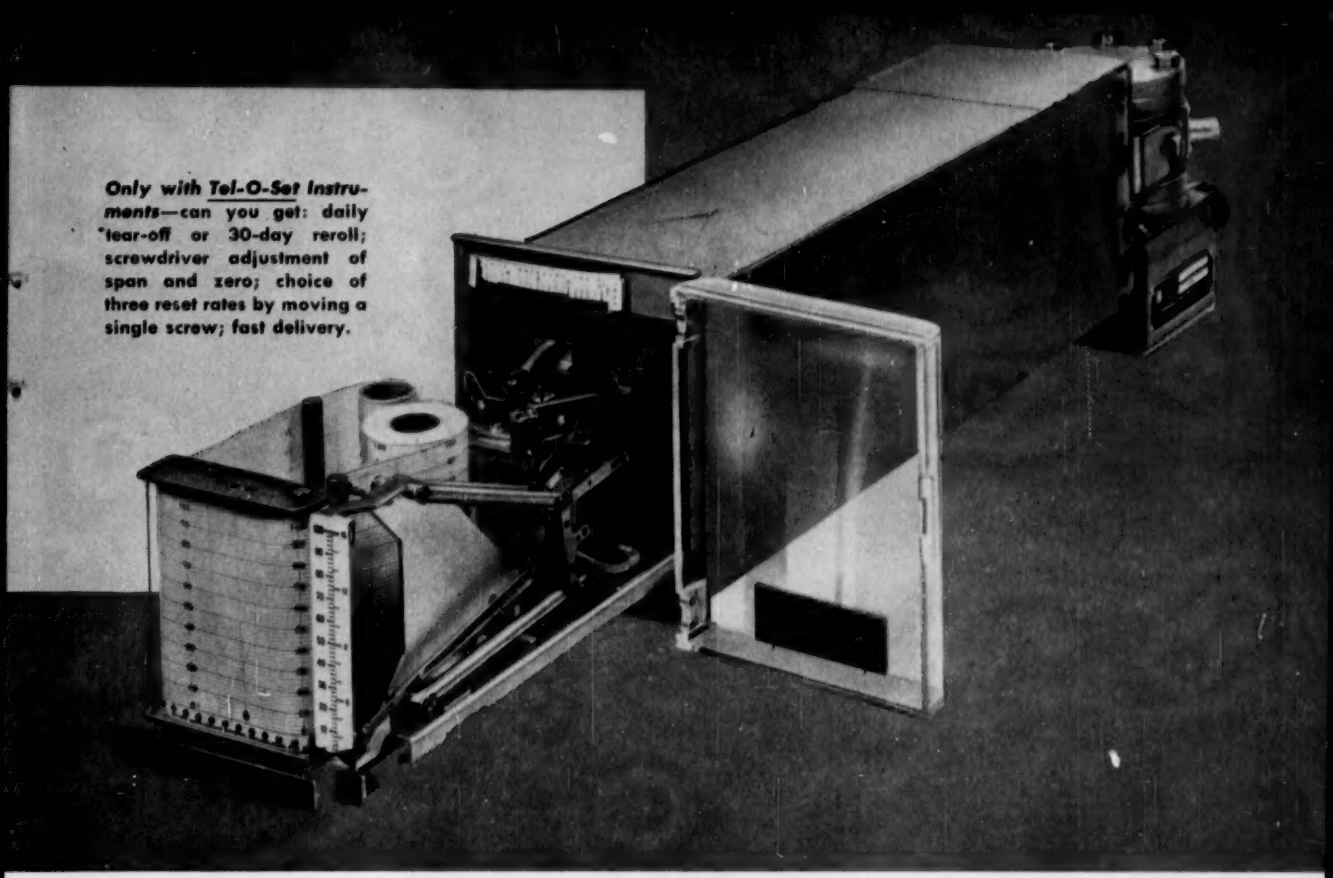
Removable Regulator—Pneumatic assembly, consisting of regulator and switches, can be removed from rear of case without disturbing electrical connections—no need for an electrician to stand by.



Quick-connect Mounting—Controllers have quick-connect switch permitting removal of the unit while process remains on manual control.



Easily Disassembled—Unitized construction of all controller components simplifies maintenance . . . makes reassembly foolproof. No need to dismantle stack to clean pilot assembly.



Savings with TEL-O-SET*

. . . advanced miniature pneumatic instruments

Tel-O-Set miniature instruments accurately record, indicate, and control process variables. They're applicable to any process variable . . . a savings in itself. And, further savings are accrued from these factors: Only a few models are needed for *all* applications . . . Personnel training time is minimized . . . Spare parts inventory is reduced . . . Process techniques can be changed without buying new instruments. The photographs point up some of the outstanding *Tel-O-Set* features.

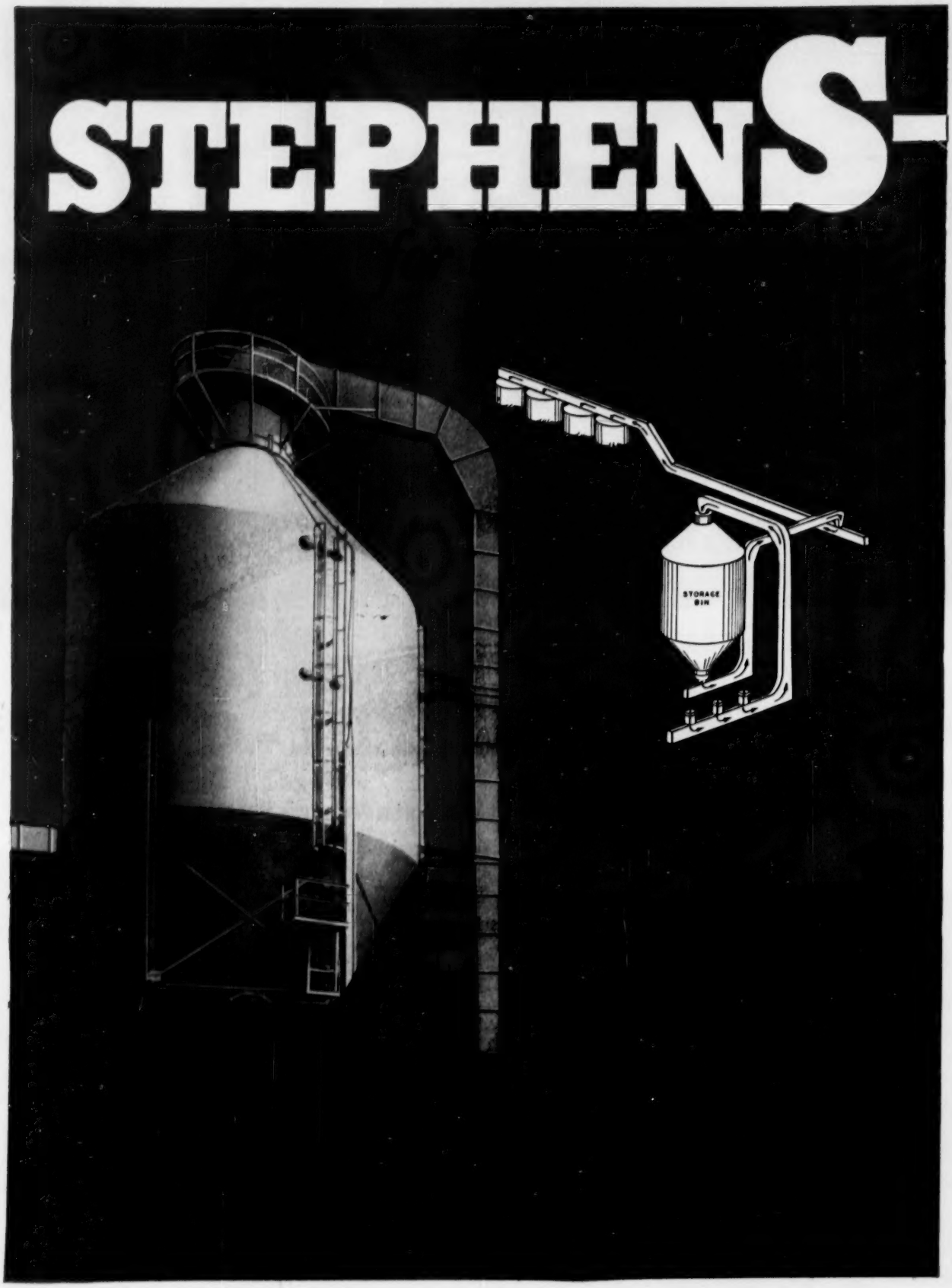
For complete information on *Tel-O-Set* instruments, write for Catalog C 1001-1, or call your nearby Honeywell sales engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

*Trade name Minneapolis-Honeywell Regulator Co.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

STEPHENS-



-ADAMSON

in bulk material conveying systems

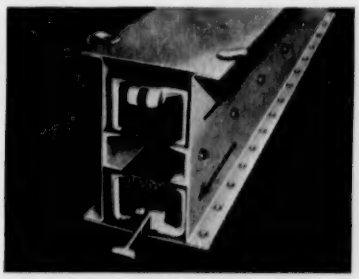
Reputation can't be bought, it must be earned. Only time can pass true judgment on the quality of a company's products or services. The reputation which goes with the brand mark on any S-A bulk material handling system has been earned by sound performance. Over fifty years of such performance is why the big name of STEPHENS-ADAMSON commands top respect among chemical processing people everywhere.

S-A systems are serving the chemical industry often under the most adverse conditions, always delivering consistent tonnage, economically and with minimum man power or maintenance effort. S-A engineers fully understand the complex problems which arise from handling a great variety of chemical products. Due to long experience their solutions to these problems are swift and accurate.

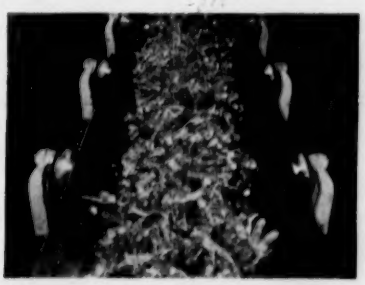
Call the S-A sales engineer in your area for a "new look" at your conveying methods. His expert advice costs you nothing and may help you cut some very expensive production corners.



S-A zipper closed belt conveyor elevator requires no casing, operates over any plane. Automatically opens and closes, conveys any granular, flaky, pulverized or small lump material affording complete protection over any distance.



REDLER conveyors-elevators move material within an enclosed steel casing which is protective and dust tight. It conveys on horizontal or inclined planes, around corners, inside or out of doors. It is compact, economical and easily erected.



Belt conveyor systems move a wide variety of bulk materials, are unlimited in length, tremendously economical in operation. They perform heavy duty, high volume jobs and are available in various arrangements, widths and lengths.



WHEN EXPERIENCE COUNTS—YOUR BEST BUY IS S-A

STEPHENS-ADAMSON MFG. CO.

3 RIDGEWAY AVENUE, AURORA, ILLINOIS
LOS ANGELES, CALIFORNIA
BELLEVILLE, ONTARIO

S-A manufactures a wide range of material handling products in three complete plants in U. S. and Canada.

- Belt Conveyors
- Belt, Pan & Plate Feeders
- Ship Loading Boom Conveyors
- Stacking Conveyors
- Storage & Reclaiming Systéms
- "Natural Frequency" Vibrating Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Conveyor Belt Cleaners
- Headshaft Holdbacks
- Grizzlies & Screens
- Centrifugal Pilers
- Bin Gates & Tunnel Gates
- Car Pullers & Spotters
- Bucket Elevators
- Skip Hoists
- SEALMASTER Ball Bearing Units

• *Write for a bulletin on any of the above products.*

In Iron Body Wedge Gate Valves,
Outside Screw and Yoke Design,

Walworth offers you these 8 outstanding advantages!

STRONGER CONNECTIONS. T-head disc to stem connection on OS&Y types permits wedge to properly seat itself.

TIGHTER SEAL. Solid web type disc on OS&Y valves provides tight closure, greater strength and longer service.

REDUCED TURBULENCE. Fluid action is minimized due to this straight-flow port design.

FEWER OBSTRUCTIONS. Seat rings of bottom seated types are screwed into body to prevent gum and grit accumulations.



Walworth Subsidiaries: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO.



SURE-GRIP HANDWHEEL. Fluted design assures a sure grip, even with greasy gloves.

HIGH CORROSION RESISTANCE. Brass liner protects glands from deterioration and scoring.

EASIER REPACKING. Hinged gland eye bolts on OS&Y valves permit fast maintenance under full pressure.

LESS DAMAGE. Bronze back seat bushing in bonnet of OS&Y valves prevents scoring, guides stem accurately.

Walworth Iron Body Gate Valves are available with screwed or flanged ends, in sizes and types for every purpose. For full information see your Walworth Distributor or write: *Walworth Company, 60 East 42nd Street, New York 17, N. Y.*

WALWORTH*

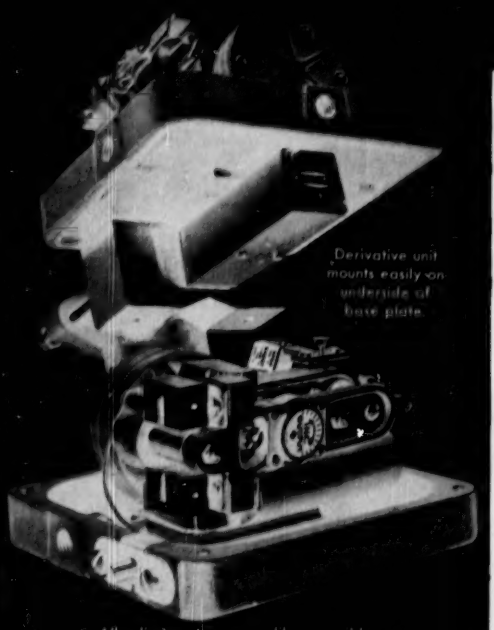
*WALWORTH is a registered trademark of WALWORTH COMPANY

DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

M & H VALVE & FITTINGS CO. • SOUTHWEST FABRICATING AND WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.

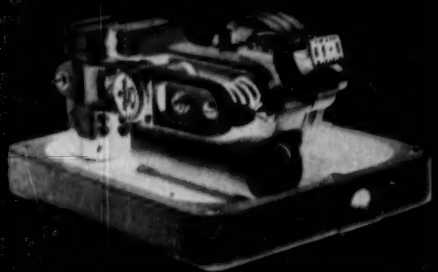
MASONEILAN TEMPERATURE TRANSMITTER

Distinguished by Exclusive Features



Derivative unit mounts easily on underside of base plate.

All adjustments are readily accessible, visible and easy to make.



Special "Balanced Beam" design permits mounting in any position without zero shift.



Important design differences in this newly developed force-balance transmitter offer advantages in accuracy and dependability. For example:

- **Balanced Beam** design permits mounting in any position without zero shift.
- **Unit subassembly** construction permits removal (for change of range, replacement or maintenance) of thermal system; compensating bellows; feedback bellows; pilot; range span adjustment assembly; derivative unit; gasketless nozzle — any or all without disassembling beam assembly in any way.
- **All adjustments visible and accessible** without disturbing any other part of the mechanism. Range span setting is unaffected by vibration.
- **Protection against damage** is provided for thermal system by a beam stop and the overrange feature; for compensating bellows by built-in stops; for entire unit by rugged weatherproof case.
- **Indicating Receiver Gauge** may be installed directly in manifolded base plate — no piping or tubing required.

A Pressure Transmitter, Too: The temperature transmitter may be readily converted to a pressure transmitter by substitution of a pressure element for the thermal system (within limits imposed by pressure conditions and characteristics of measured fluid).

Write for bulletin or secure details from our nearest office.

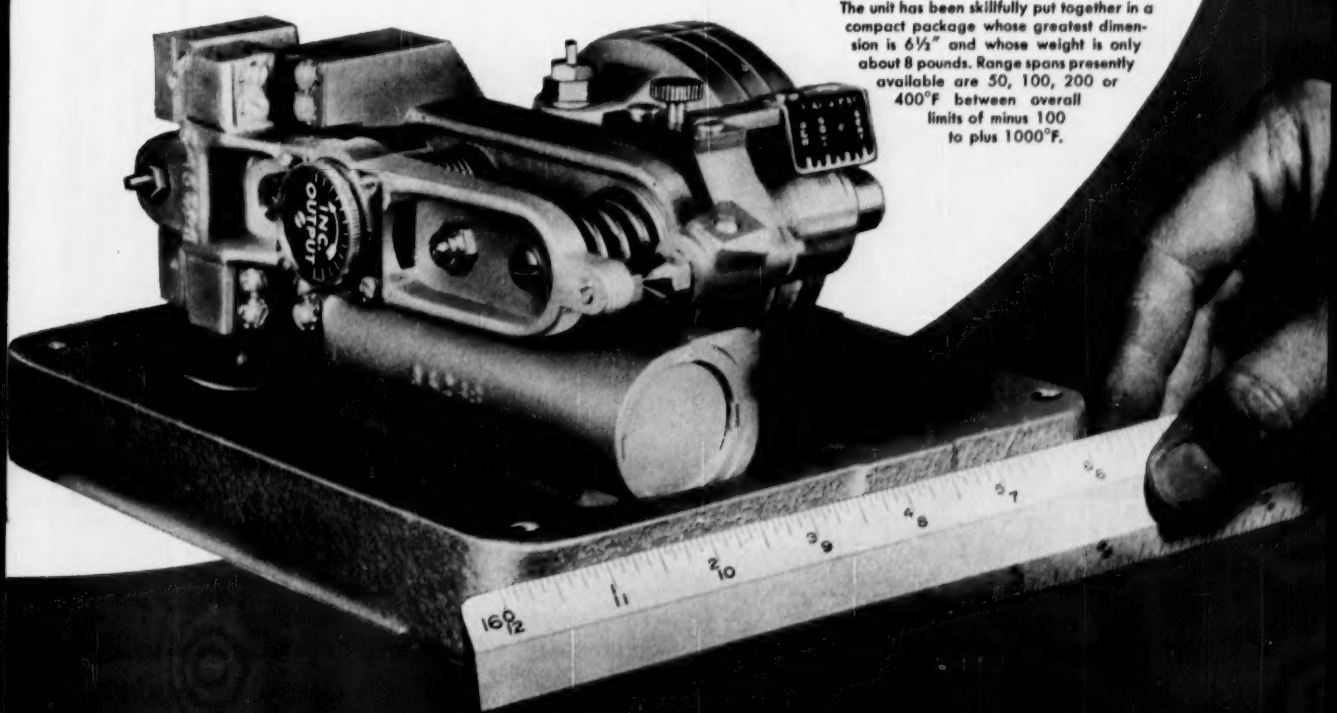
MASONEILAN

MASON-NEILAN

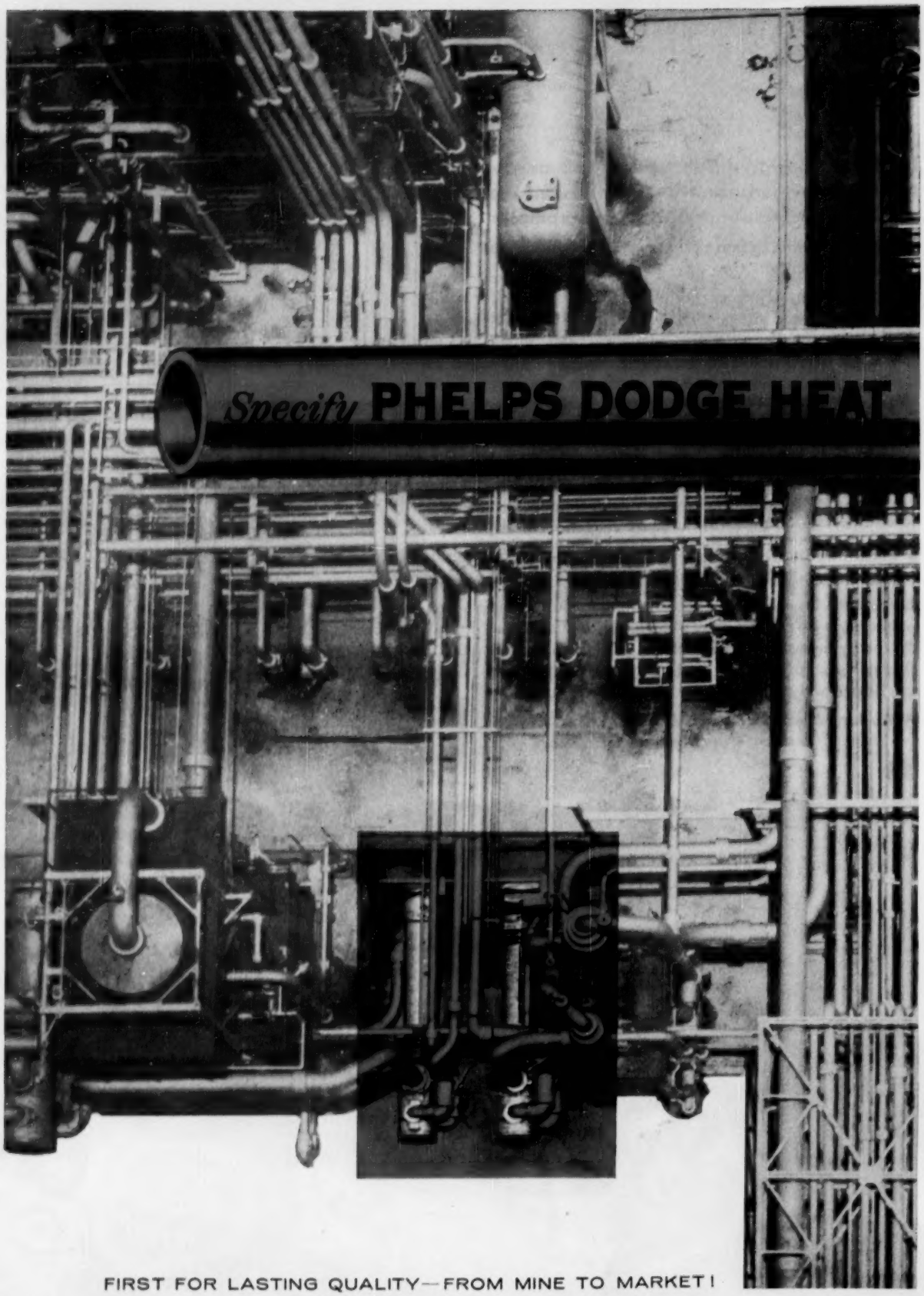
Division of Worthington Corporation

67 NAHATAN STREET, NORWOOD, MASSACHUSETTS

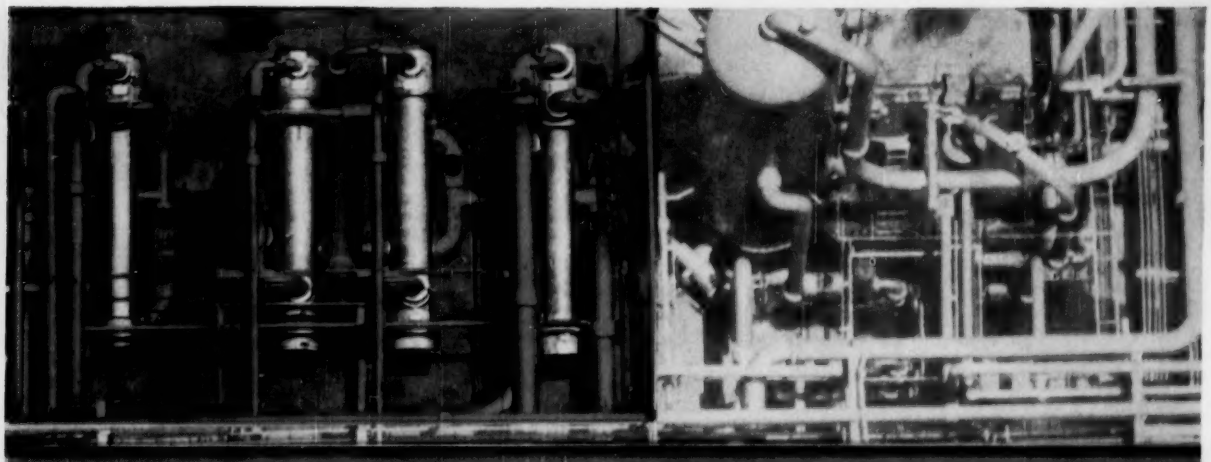
SEVENTY-FIFTH ANNIVERSARY



The unit has been skillfully put together in a compact package whose greatest dimension is 6½" and whose weight is only about 8 pounds. Range spans presently available are 50, 100, 200 or 400°F between overall limits of minus 100 to plus 1000°F.

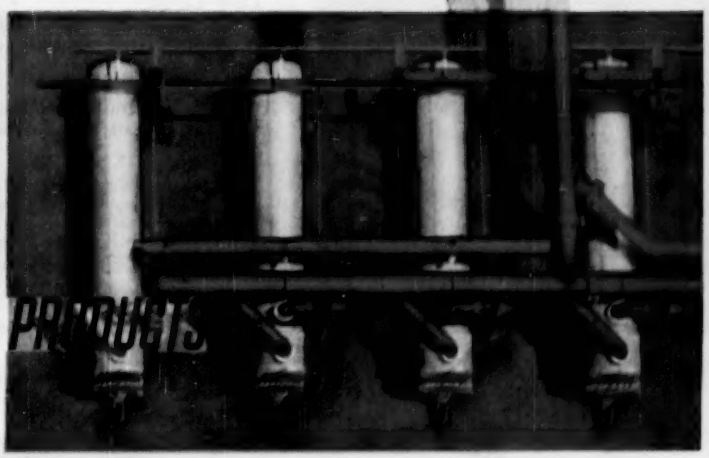


FIRST FOR LASTING QUALITY—FROM MINE TO MARKET!



EXCHANGER TUBES *for Longer Service!*

- Full range of copper-base alloys for every application.
- Vast background of application engineering to assist in proper alloy selection.
- Complete control of quality throughout every step of manufacture.



PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

Here's why your best steam trap buy is Yarway Impulse

THERE'S A YARWAY IMPULSE STEAM TRAP FOR EACH OF THESE REQUIREMENTS

As shown opposite, no matter what your need—normal loads, high capacity, low capacity, high pressure, low pressure—Yarway has an *impulse* trap to meet it.

GETS EQUIPMENT HOT FAST—KEEPS IT HOT

Yarway pioneered the application to steam traps of the principle of thermodynamics that makes possible quick heat-up, and high, steady temperatures. Result—peak efficiency from equipment.

ONLY ONE MOVING PART

A little valve is the only moving part. Nothing could be simpler.

LOW MAINTENANCE

Design and material make Yarway Impulse Traps practically trouble-free. A handful of spare parts will service a plant-full of traps.

SMALL SIZE . . . LIGHT WEIGHT

Fit in anywhere. Require no supports or special piping.

GOOD FOR ALL PRESSURES

No change of valve or seat for any pressure up to specified maximum.

NON-FREEZING

Great for outdoor installations. Won't freeze up, because condensate can't accumulate—there's nothing to freeze.

LOW COST

It often costs *less* to install a new Yarway Impulse Trap than to repair a conventional-type trap.

CONVENIENT SUPPLY

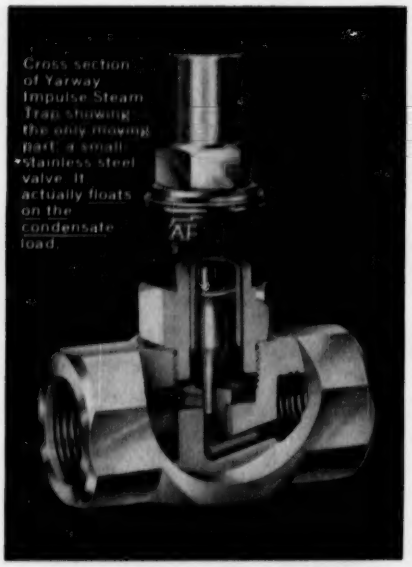
Over 270 Industrial Distributors stock and sell Yarway Impulse Steam Traps. One is near you.

NATION-WIDE SERVICE

34 trained Yarway field engineers, located in every corner of the country, give you quick, helpful steam trap service.

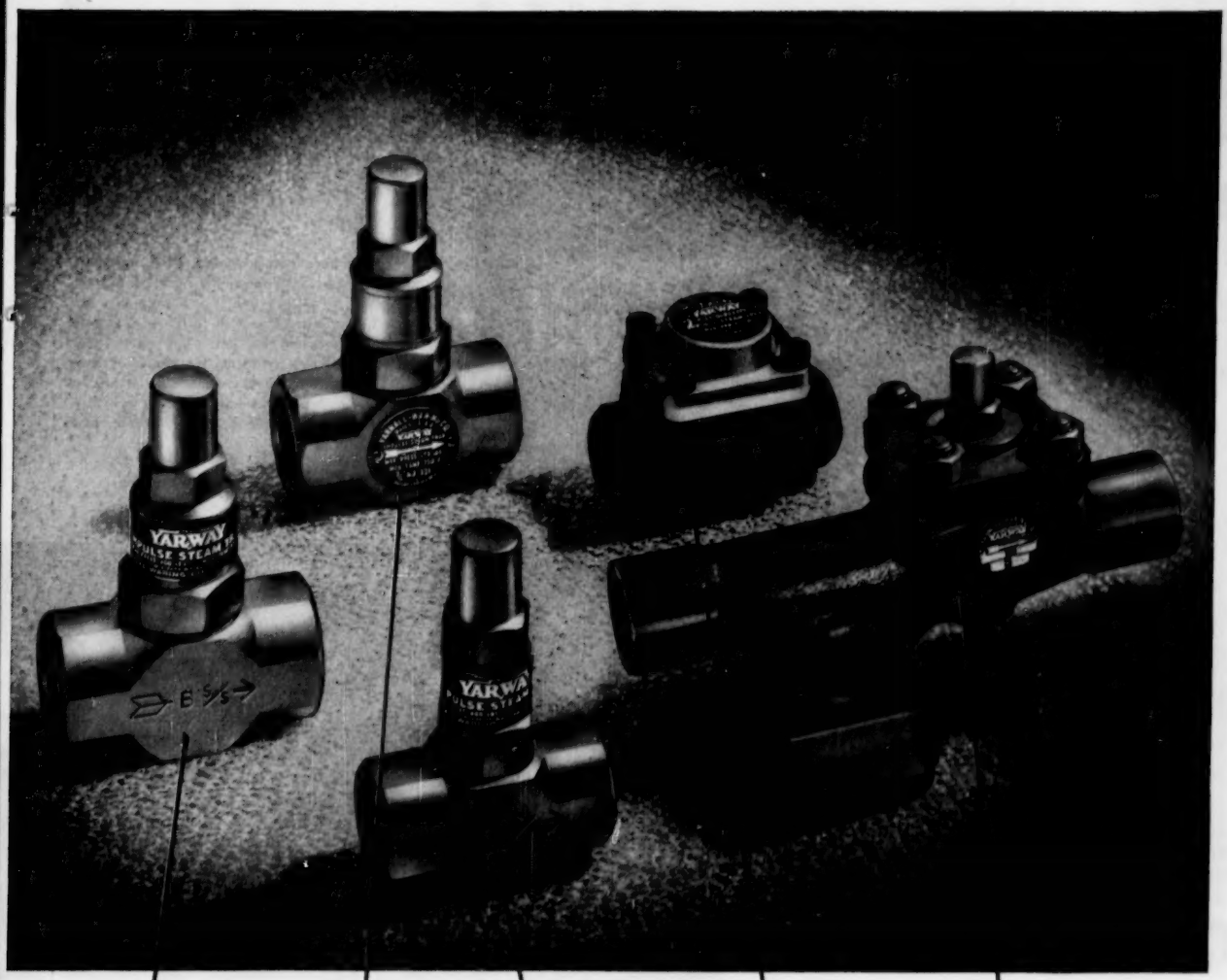
Want the free booklet "Banish Your Steam Trap Troubles" . . . or the Yarway Trap catalog? Write

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.



more than a million sold!

YARWAY ... a good



CHOOSE THE RIGHT IMPULSE STEAM TRAP FOR YOUR JOB

NORMAL REQUIREMENTS
Use Yarway Series 60 traps. All pressures to 400 psi and temperatures to 450°F. Six sizes ½" to 2".

HIGHER PRESSURES AND TEMPERATURES
Use Yarway Series 120 traps for pressures to 600 psi and temperatures to 750° F. Six sizes ½" to 2".

LIGHT LOADS
Use Yarway No. 20-A trap where condensate loads are especially light. (Available only in ½" size.)

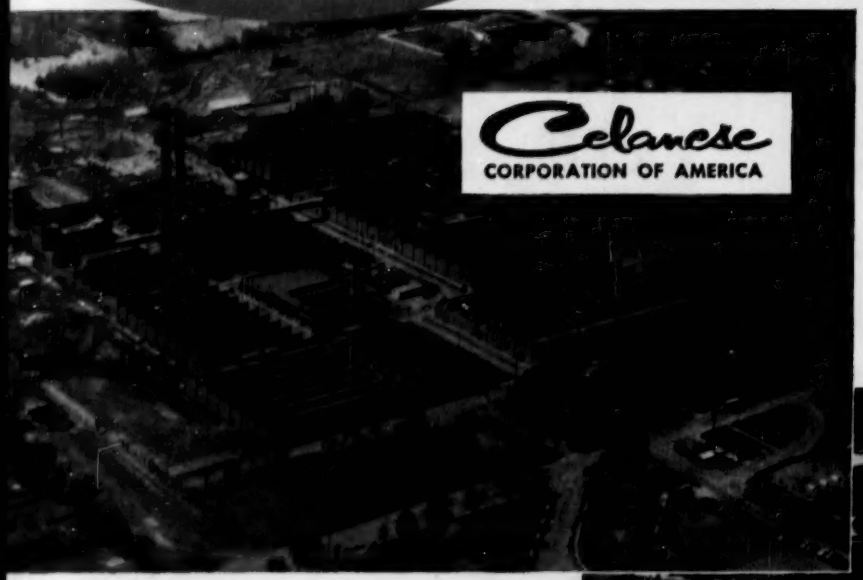
HEAVY LOADS
Use Yarway Series 40 traps where condensate loads are especially heavy. Five sizes, ½" to 2½".

INTEGRAL STRAINER
For high pressure power plant trapping, also marine use, specify Yarway Integral Strainer Traps. Welding or flanged connections.

way to specify steam traps

Carrier

Major chemical concept in Absorption Air Conditioning



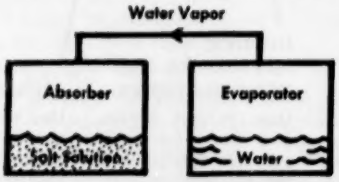
Celanese Corporation of America, Rome, Georgia plant. Producers of Fortisan-36, a regenerated cellulose yarn made from wood pulp by an entirely new process. Expected to fill the gap between industrial steel wire and high-tensile rayon and glass, this new synthetic, a product of four years research and development, is expected to be used in high-pressure hose, V-belts, webbing, paper laminate reinforcing, Army tents and rubber tires.

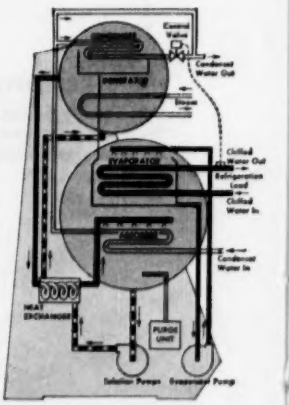


Production area where Fortisan-36 is made and spun. Processing temperatures that approach 130°F. require comfortable cooling for efficient work.

Temperatures in the production area of Celanese Corporation of America's new fiber manufacturing plant at Rome, Georgia, where the new super-strong industrial rayon yarn Fortisan-36 is made and spun, would rise as high as 130°F. if the building were not comfortably cooled. To permit manufacturing personnel to work efficiently, a Carrier Absorption Refrigeration Machine of 518 tons capacity was installed to provide chilled water for the plant's existing air handling system, which is also Carrier. Using low pressure steam to produce refrigeration for air conditioning, this simplest of all refrigerating machines uses the cheapest, safest and most available of all refrigerants—common tap water. Its absorbent is Lithium Bromide Brine, also known as "Carrene 16".

HOW CARRIER'S ABSORPTION REFRIGERATION CYCLE OPERATES





The simplest cycle diagram would include Evaporator and Absorber (upper left). Consider these two closed vessels with salt (Lithium Bromide) solution in one and plain water in the other. Just as common table salt absorbs water vapor from the air on a damp day, the Lithium Bromide salt solution in the absorber has affinity for water vapor and evaporates some of the water. Water that remains in the evaporator tank is thus chilled by evaporation and thereby produces a refrigeration effect. In actual operating practice a condenser and generator are combined in the upper shell of the machine, and the evaporator and absorber in the lower shell (see upper right cycle diagram).

member of...

PROCESSORS OF LITHIUM METAL • METAL DISPERSIONS
METAL DERIVATIVES: Amide • Hydride
SALTS: Bromide • Carbonate • Chloride • Hydroxide • Nitrate
SPECIAL COMPOUNDS: Aluminate • Borate • Borosilicate • Cobaltite • Manganite
Molybdate • Silicate • Titanate • Zirconate • Zirconium Silicate

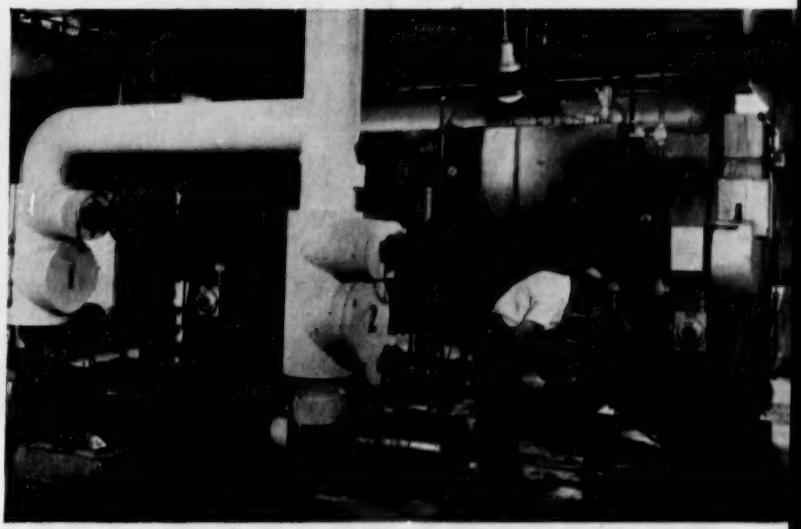
BRANCH SALES OFFICES: New York • Chicago • Bessemer City, N. C.
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RESEARCH LABORATORY: St. Louis Park, Minnesota

Carrier and Lithium Corporation team up to cool down Celanese Super-Yarn plant

AUTOMATIC ABSORPTION REFRIGERATION BY CARRIER UTILIZING LITHIUM CORPORATION'S LITHIUM BROMIDE BRINE AS THE ABSORBENT COOLS WATER WITH STEAM

•

SYSTEM OPERATION IS SIMPLE, COMPACT, QUIET, DEPENDABLE, ECONOMICAL, RELIABLE, CONTINUOUS



518 ton Carrier Absorption Refrigeration machine. System is automatic and completely cyclic.

Using the heat energy from steam to produce cooling thru chilled water, Carrier absorption machines can be installed anywhere space and steam are available. Turning to the oldest refrigeration principle—the absorption cooling cycle—Carrier has perfected a machine whose size, weight, lack of moving parts and vibrationless operation permit its use from subbasement to rooftop. Operation is completely automatic, governed by the simple "stop-go" pushbutton or thermostat or time-clock control. Cooling output is varied automatically from full to zero load and back again with little loss in efficiency. And there is nothing that can be damaged in the event of overload. Made in capacities from 60 to 700 tons, all units rely on Lithium Bromide Brine for their absorbent salt.

LITHIUM BROMIDE ABSORBENT USED IN ALL CARRIER UNITS

Completely safe, Lithium Bromide is shipped to the installation in drums as a 54% brine. Once the unit is charged, the salt solution never wears out or needs replacement. LiBr is unique in that it can be concentrated to as high as 65% without crystallizing, and when adjusted with respect to alkalinity, can be used without a corrosion inhibitor.

GOT AN ABSORPTION PROBLEM?

Lithium brines—bromide and chloride—may be used in either direct contact absorption or refrigeration systems. Other possible industrial applications include gas absorption, deicing fluids, low temperature heat transfer media, pharmaceuticals, welding rods, brazing fluxes, heat treating salts, and electrolytes for low temperature dry cells. Lithium brines are extremely soluble in water, completely non-volatile, odorless, enjoy a low specific heat, and exhibit practical deviations from Raoult's law.

Let us investigate whether our Sales Department can solve your application problem. Send in the coupon today ➡

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Ready in volume...

for BOTH Nuclear and Chemical Application

Metallurgically sound zirconium ingots are being produced now in quantity by CARBORUNDUM Metals in its worlds first *fully integrated* zirconium plants—to meet your most exacting specification requirements. Certified zirconium ingots, melted under positively controlled vacuum or inert atmospheres by the manufacturer gives you *one source of supply* for ready-to-fabricate metal...completely eliminates risk of converting from sponge at *your* responsibility...provides certified ingots at a fixed price.

CARBORUNDUM Metals' long experience as a leading supplier of zirconium to the U.S.A.E.C.—plus an unrivaled production record assures you of *top quality* metal in *quantity* from the two most modern sponge producing plants in the industry ...at Akron, N. Y., and at Parkersburg, West Virginia.

Ask to be placed on the mailing list of "More ZR Facts," the zirconium industry's first continuing source of technical information.



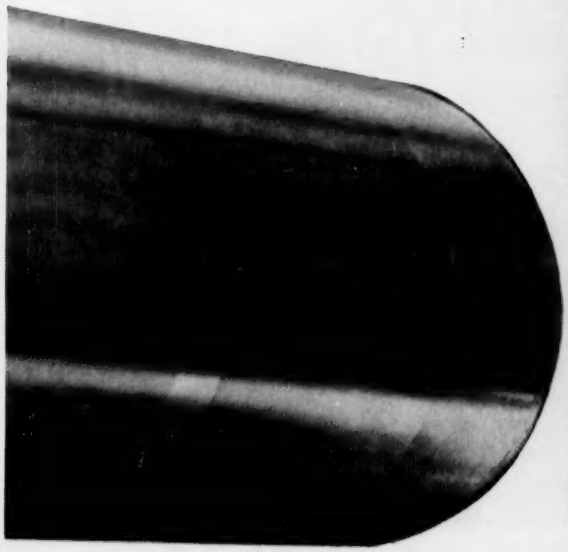
● Ingot melt control panel scientifically regulates atmosphere and melting conditions through first and second melts.

● Operator mechanically conditions zirconium ingot to remove surface irregularities from cast ingot wall.

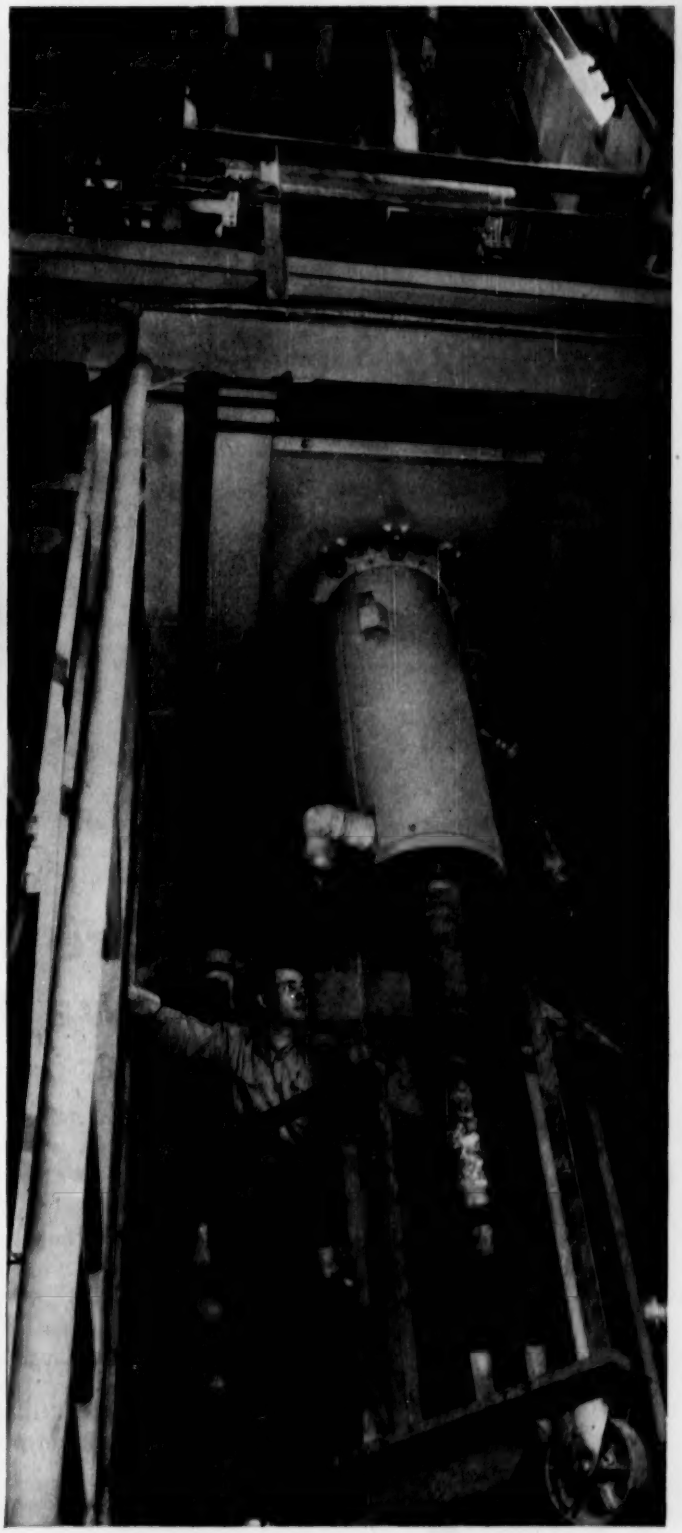
● Brinnel hardness test taken at as many as ten intervals along ingot to assure uniform mechanical properties.

● Testing ingot soundness with Ultrasonic Reflectoscope to inspect for internal porosity and irregularities.

SECOND MELT certified ingot ready for fabrication. Ingots are produced from 500 to 2500 lbs. each in 12″ to 16″ diameters. From zircon sand to zirconium ingot by *one* manufacturer—quality controlled all-the-way with Proven Methods, Proven Quality and Proven Performance.



FIRST MELT ingot being withdrawn from the positively controlled vacuum or inert-atmosphere furnace at CARBORUNDUM Metals.



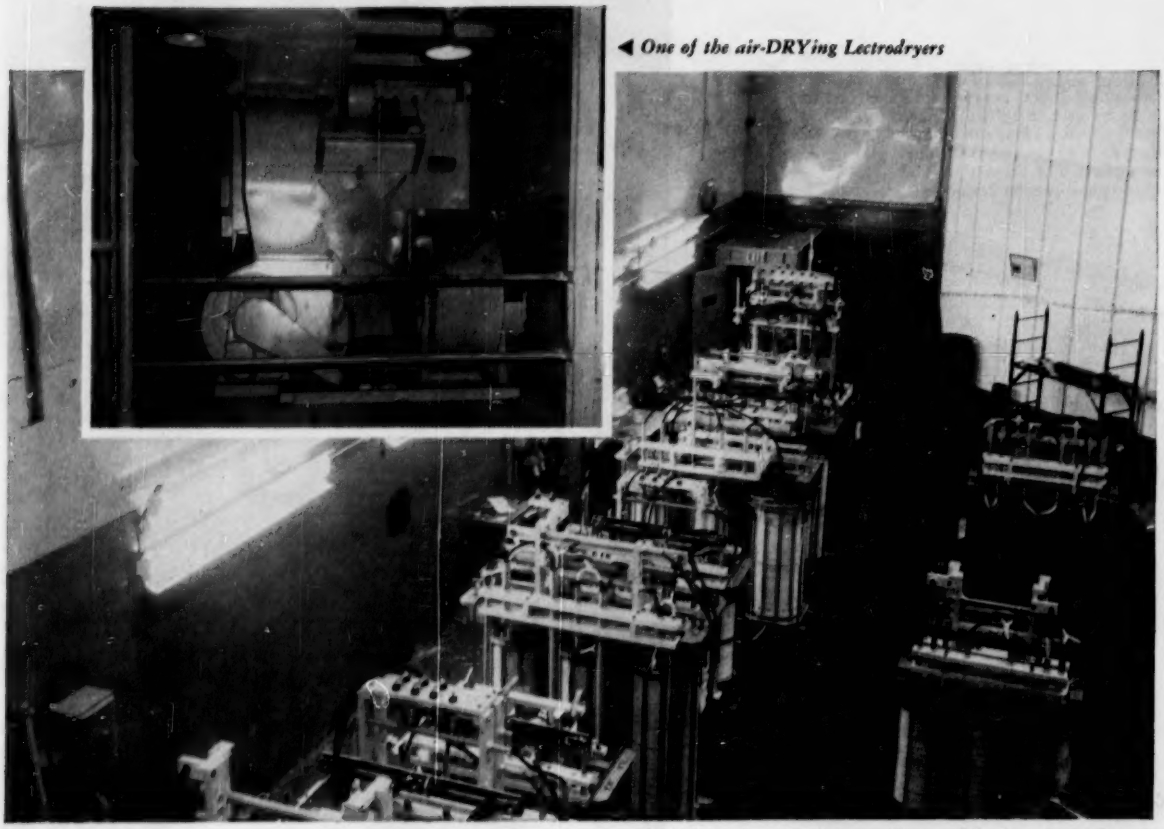
ZIRCONIUM INGOTS, Zircaloy ingots and sponge metal for open market use, are available for shipment now to any location in the free world in both reactor and commercial grades. CARBORUNDUM Metals' close relationship with leading zirconium fabricators who are geared to produce, provides you with immediate, reliable sources for on-specification welded or seamless zirconium tubes, zirconium sheet, strip, bar, rod, wire and foil.

WRITE TODAY... for latest price lists—technical data and delivery on all zirconium products. CARBORUNDUM Metals' highly qualified staff of metallurgical engineers, zirconium specialists, are available for assistance and recommendations—without obligation.

Visit us at The Trade Fair of the Atomic Industry, The Coliseum, New York, Oct. 28-31. Booths 222-223

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Division of THE CARBORUNDUM COMPANY

Production Pioneer of ZIRCONIUM



◀ *One of the air-DRYing Lectrodryers*

This 210,000 cubic foot area is served by four Lectrodryers®

Transformers are held in DRY room awaiting assembly

500 to 7,500 KVA transformers built by General Electric Company at Rome, Georgia, are given the vapor phase treatment before assembly. Cores and coils are heated in a vacuum, sprayed with hot oil to seal against moisture infiltration, then placed in this DRY room.

Four Lectrodryers hold this huge area between 3% and 11% relative humidity. Although automatically controlled, as an added precaution, an alarm is set to sound if the moisture level rises above 8%.

In dozens of industries, Lectrodryers are contributing to quality and speed of production—DRYing air, gases and organic liquids. Installations are pictured in the booklet, *Because Moisture Isn't Pink.* For a copy, write Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Stein & Roubaix, 320 Rue du Moulin, Bressoux-Liege.

Lectrodryer

®REGISTERED TRADEMARK U. S. PAT. OFF.

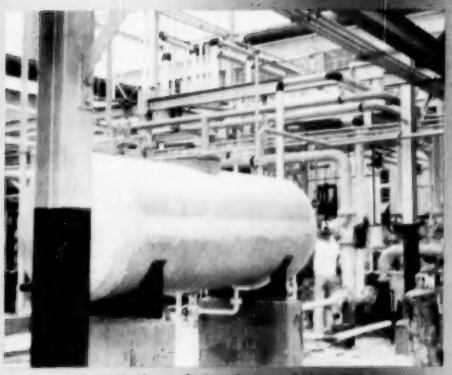
In Aluminum too...

TUBE-TURN

...a three-way saving in your piping dollars

When you specify TUBE-TURN* products, you are sure of getting the exact fittings for your job because the Tube Turns' line is the world's most complete . . . *you save engineering time.* Your welders can work faster because fittings are completely identified and perfectly uniform . . . *you save construction time.* You can buy all your fittings with one order from your nearby Tube Turns' Distributor . . . *you save purchasing time.* Are *you* getting these savings in piping costs?

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.



Installation of aluminum piping for handling ammonium nitrate.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS

LOUISVILLE 1, KENTUCKY

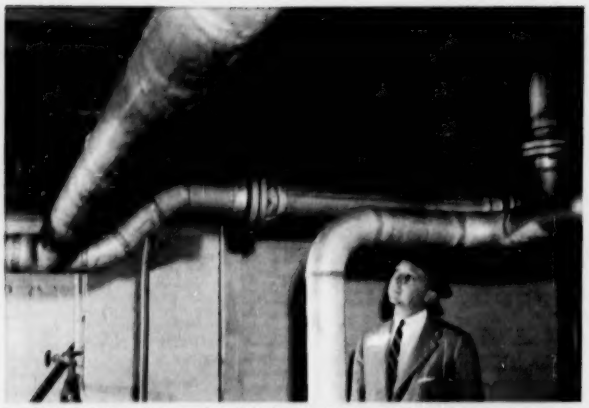
A DIVISION OF NATIONAL CYLINDER GAS COMPANY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland • Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle. **IN CANADA:** Tube Turns of Canada Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec.

OTHER APPLICATIONS SHOWN ON REVERSE SIDE ▶

In Aluminum piping too...

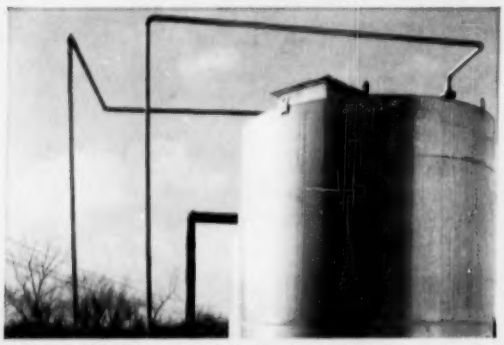
You save manhours with the line of 12,000 TUBE-TURN products



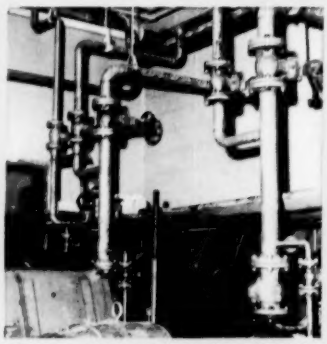
LIQUID SUGAR. Part of welded aluminum piping system for processing of liquid sugar. When you specify TUBE-TURN® products, you can count on getting the right type, size, schedule and material for every piping service. Saves engineering manhours.



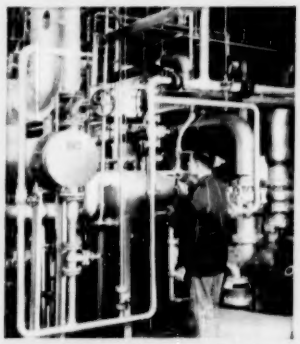
"A-POWER." These TUBE-TURN Aluminum Elbows are for nuclear swimming pool reactor water-coolant lines. Tube Turns' experienced engineering service helps you solve piping problems of all kinds. Contact your nearby Tube Turns' Distributor or District Office.



OLEIC ACID. These welded aluminum lines for oleic acid storage show how this strong but lightweight construction can be utilized for corrosive service. Your nearby Tube Turns' Distributor can give you complete-line service promptly . . . to help you save purchasing time.



REFINERY CATALYST is handled by this aluminum piping, equipped with TUBE-TURN welding fittings and flanges. Uniformity of TUBE-TURN products saves construction manhours



PURE WATER. Passive aluminum piping guards against contamination in this water purification plant. You can buy *all* your fittings with *one* order when you specify TUBE-TURN products.



TUBE TURNS, Dept. H-7
224 East Broadway, Louisville 1, Kentucky

Please send free copy of new catalog on Aluminum Fittings and Flanges.

Company Name _____

Company Address _____

City _____ *Zone* ____ *State* _____

Your Name _____

Position _____

Available from your nearby TUBE TURNS' Distributor



*"TUBE-TURN" and "TT" Reg. U. S. Pat. Off.

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DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland • Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle. **IN CANADA:** Tube Turns of Canada Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec.

Centrifugal

SOLID PLASTIC PUMP

The fluid end of this pump is solid plastic, not simply lined or coated. The chemical resistance exists throughout instead of being confined to a thin surface layer. The plastic is a composition known by the trade name of HAVEG which is exceptionally resistant to most acids, bases, and salts, to chlorine, and to many solvents and other chemicals excepting those of a highly oxidizing nature. It can be used continuously at temperature ranges to 265° F.



Capacities to 325 gpm. Heads to 158 feet. 2-inch discharge, 3-inch suction, one size only.

MISSION MANUFACTURING CO.

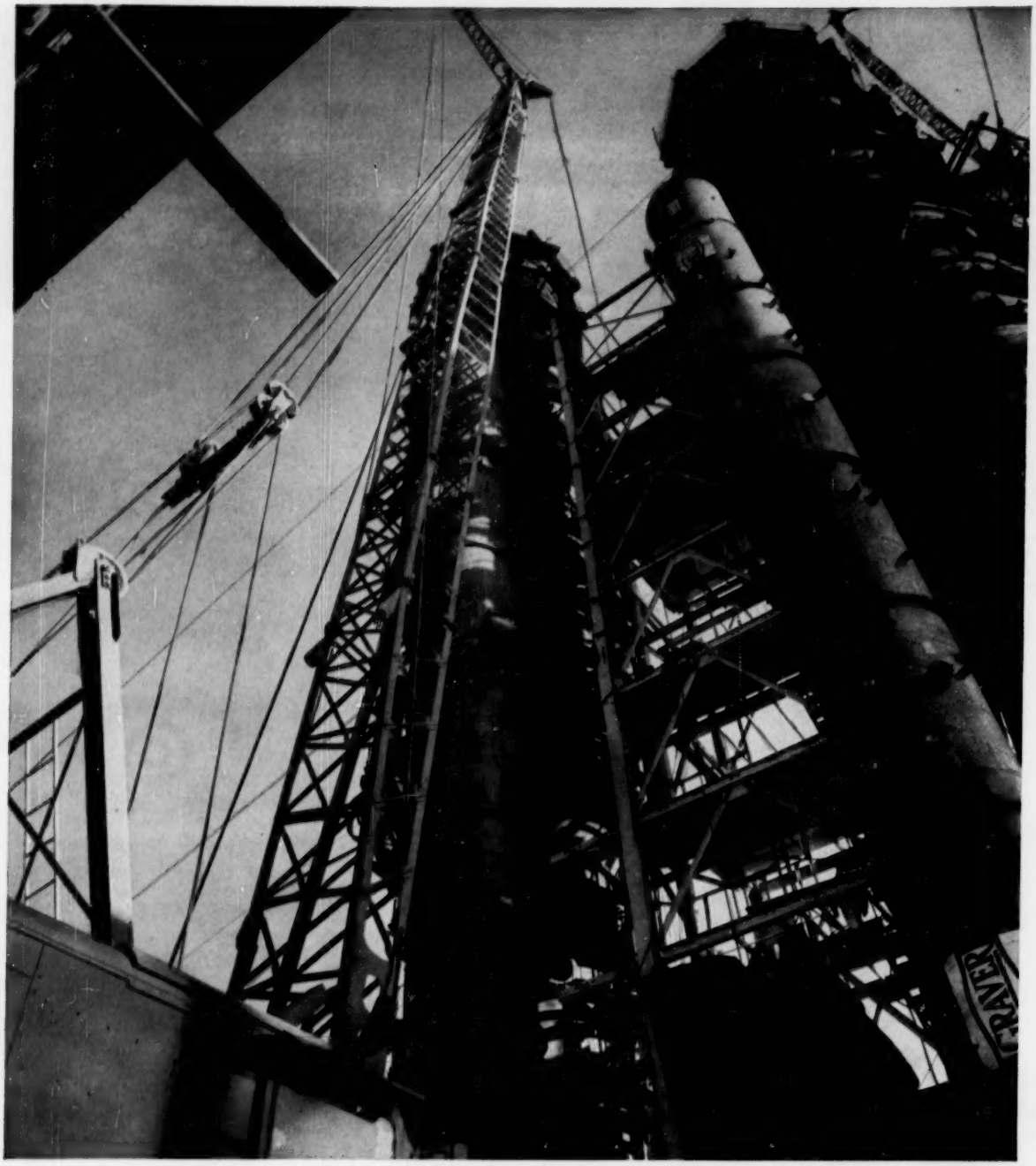
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Export Office: 30 Rockefeller Plaza, New York

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NEW MONUMENTS TO EFFICIENCY!

These huge stripper columns were produced with typical Graver craftsmanship. Shop fabricated from ASTM A-285 Grade C firebox quality steel, they represent one of many types of processing equipment Graver has been fabricating for 100 years.

1857-1957 GRAVER Our 100th Year

Building for the Future on a Century of Craftsmanship in Steels and Alloys

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
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ALLIS-CHALMERS

Dielectric Heaters

The application list is growing...

- ✓ Drying cellulose sponge
- ✓ Setting resin adhesives for wood bonding
- ✓ Gelling, curing, drying foam rubber
- ✓ Drying crumb rubber for Mooney test control
- ✓ Curing resin-impregnated paper
- ✓ Setting twist for rayon cord
- ✓ Heating plastic preforms
- ✓ Laboratory and research projects



Allis-Chalmers dielectric heaters are available in a complete range from 3 kw to 100 kw.

You, too, can

cut costs • save space • speed production with Allis-Chalmers dielectric heaters

Processing time measured in minutes . . . maximum production per unit of floor space . . . streamlined work flow . . . minimum heat loss . . . improved working conditions . . . simplified operation — these advantages are yours with the Allis-Chalmers dielectric heater.

If your processing requires the heating of non-conducting materials, the application of Allis-Chalmers dielectric equipment and engineering will mean faster production and lowered costs. The experience gained by Allis-Chalmers engineers in designing hundreds of dielectric and induction heating installations is available for your operations.

See your nearby Allis-Chalmers representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for bulletin 15B6431C.

ALLIS-CHALMERS

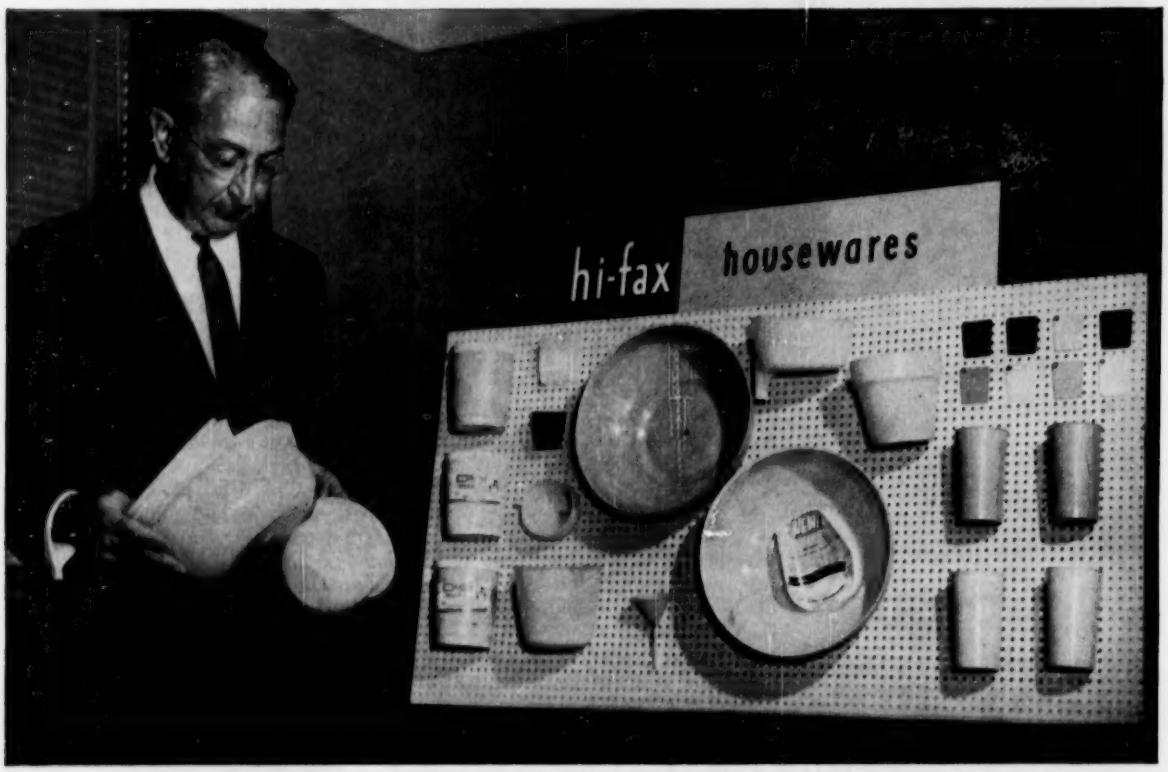
A-5303



HOW HERCULES HELPS...

WITH PENTAERYTHRITOL. Outstanding resistance to heat, to light, and to moisture have made PE-based alkyd resins the preferred approach to many of the newest developments in surface coatings. Other applications for this new chemical—in such things as vinyl plastics, fire-retardant paints, and floor coverings—are growing rapidly. The demand for PE has skyrocketed. And Hercules, with a new Midwest producing plant, is assuring ample room for even further product developments.

WITH PLASTICS. The first commercial plant utilizing the famed Ziegler process is now on stream in Parlin, N. J. producing Hi-fax®. This completely new Hercules ethylene polymer offers a combination of characteristics never before available in any plastic. The panel board below displays some of the superior housewares made with Hi-fax. Providing many advantages over conventional polyethylene, Hi-fax is already finding other applications in a wide variety of products.



HERCULES

HERCULES POWDER COMPANY
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900 Market St., Wilmington 99, Del. Sales Offices in Principal Cities

CHEMICAL MATERIALS FOR INDUSTRY

G57-8

You get *lower unit cost*



with stainless containers from

The comparison above is proof of the lifetime service you get from USS Stainless containers. *The longer you use them, the more you save.* If yours is a product that needs the extra protection of stainless, then profit from US Steel's unequaled experience with this type container. Exclusive welded chimes . . . reinforced rolling hoops . . . five to 55-gallon capacities. Send for this free report on USS stainless containers . . . .



Profit from all 5 of these U.S. Steel extras, too:

- **Eye-catching containers** — your containers not only ship your product, but advertise it, too — when color-decorated by U.S. Steel.
- **Best rust protection** — there's more zinc phosphate on every USS rust-inhibited container.
- **Prompt container delivery** — a 7-point factory system gives you next-door service anywhere — any time.
- **Personalized container service** — your U.S. Steel salesman makes it his business to understand yours — to help you get the right containers for your needs.
- **Widest container variety** — from 2½-gal. pails to 55-gal. drums, including stainless.

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USS STEEL DRUMS

USS

UNITED STATES STEEL



Keep plant space flexible with BLAW-KNOX Electroforged® Steel Grating

If expanding production set-ups are cramping feeder and storage areas in your plant, it will pay you to check into Blaw-Knox Electroforged Steel Grating.

Storage platforms of Blaw-Knox steel grating put unused space to work easily, economically. There's nothing to wear, nothing to patch. Blaw-Knox Electroforged grating fits neatly around pipes, beams and machinery without any alterations to the building, and, at the same time, admits maximum light and ventilation to the entire area.

Blaw-Knox Electroforged Grating for walkways, stair treads and floors is fabricated to your specifications to meet your own operating conditions. Complete data on all types is contained in Bulletin No. 2527. Write for your copy today.



BLAW-KNOX COMPANY

BLAW-KNOX

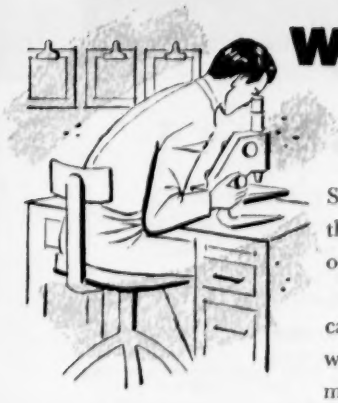
Equipment Division
Dept. C, Pittsburgh 38, Pa.

Microscopic Enemies?



Magnification 800X

Layne Research Defends Your Well Water Supply



Shown here is an actual photograph of one of the many microscopic organisms which may occur in any type water supply.

Layne Research is called upon when well capacity is reduced. Layne Research finds out why. Production records, water analysis and microscopic examinations are some of the methods used to find the reason. Layne Research, thru years of experience in "recovering lost water," selects the correct Laynite material and method to restore well capacity.

IDENTIFY AND PRESCRIBE — that's what Layne Research does for each individual well water problem.

Only Layne Offers Complete Service: *Research* • *Analysis* • *Design* • *Wells* • *Pumps* • *Maintenance* • *Engineering*

1882 — 1957 Layne 75 YEARS OF PROGRESS

WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

LAYNE & BOWLER, INC. MEMPHIS

General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Leading firms specify **SOLA-FLEX®**



These 120 Sola-Flex Joints go into new ALCOA plant

MORE AND MORE LEADING FIRMS specify Sola-Flex industrial expansion joints to help solve difficult pressure and temperature problems. This shipment of bellows will be used in Aluminum Company of America's smelting plant at Point Comfort, Texas—and other volume orders are scheduled for petroleum, chemical, power and many other industries requiring durable, economical expansion assemblies.

Solar manufactures the most comprehensive line of bellows and expansion joints in the world. Types include convoluted, U-span, rectangular and custom-built joints for specific problems. Stainless steel and heat-resistant alloy bellows have been built for service from −320 F to 2000 F. And they have been supplied in sizes ranging from ½ inch to the world's largest—28 feet in diameter.

Hot or cold, large or small, high pressure or low—no matter what your particular piping need, experienced Solar engineers can recommend exactly the right expansion joint for you. Write today for the latest Sola-Flex catalog. Dept. D-82, Solar Aircraft Company, San Diego 12, California.

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF GAS TURBINES EXPANSION JOINTS • CONTROLS • AIRCRAFT AND MISSILE COMPONENTS

ALL IN ONE MIXER:

3 way action for better and faster blending



It takes more

. . . than a simple stirring, tumbling or agitator action to turn out a smooth, uniform blend of wetted, semi-plastic or plastic materials.

And it's more true today than ever before. You're getting better, more uniform raw materials—you're paying more for them and expecting more *out* of them when it comes to quality control. That's why it will pay you to take a careful look at the equipment you're using to mix these materials.

In the Simpson Mix-Muller you get a unique three-way kneading, smearing, spatulate action. Materials are not merely stirred or tumbled together. It's an intensive controlled *mulling* action that eliminates balling, breaks up agglomerates and actually *coats* one material with the other. Dispersion of moisture, binders or carriers is thorough, uniform and quickly accomplished. You get a mix that *stays* mixed, one that is unaffected in either storage or transit.

A trial will tell the story of how mulling can help you make the most of modern materials and methods. A *mulling test* on your own materials, conducted to your own standards under your supervision, if you prefer, can be arranged. Write for details and remember . . .

MIXING IS OUR BUSINESS

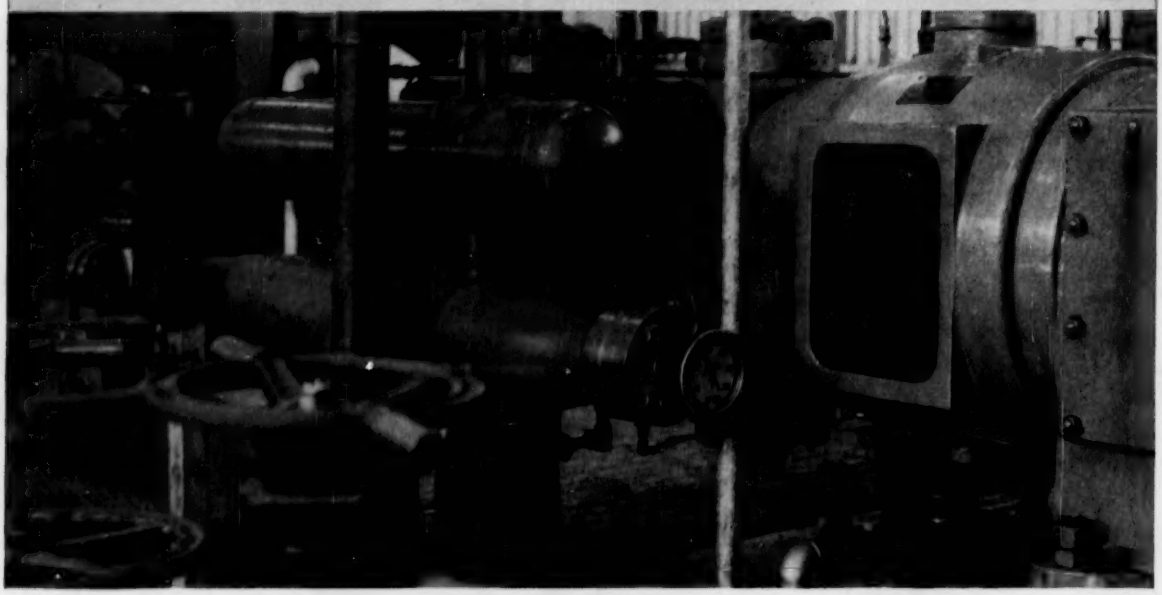


SIMPSON *MIX-MULLER*® DIVISION

NATIONAL ENGINEERING COMPANY

636 Machinery Hall Bldg. • Chicago 6, Illinois

VIBRATION



Vibration of refinery compressor proves unshakable accuracy of RMC thermometer

The RMC Thermometer shown in the photograph is constantly subjected to extreme vibration from the two-stage Synthesis Gas Compressor on which it is installed. This powerful equipment is used to compress a mixture of H_2 and N_2 from 400 to 3500 pounds—at the Philadelphia Synthetic Ammonia Plant of The Atlantic Refining Company.

This particular job required a special thermometer that could withstand the constant and terrific vibration, and at the same time provide and maintain precise, accurate readings. Rochester Manufacturing Company promptly came up with the answer—a silicone-dampened, bimetallic, angle-form RMC thermometer. And this is but one example of how RMC engineering skill provides instruments that meet the most demanding and exacting requirements.

Look to RMC for Full-Line Instrumentation



DIAL THERMOMETERS

Illustrated here is a 6" dial thermometer with hermetically sealed dial chamber, external recalibration—built for heavy duty service. What are your thermometer requirements?

PRESSURE SWITCHES



This RMC Pressure Switch will stand heavy pulsating pressures, has close on-off differentials, maintains consistent cut-in, cut-out settings. What are your pressure switch problems?

TELL US YOUR REQUIREMENTS FOR DIRECT MOUNTING AND REMOTE INDICATING INSTRUMENTS, AND LET RMC ENGINEERING SKILL PROVIDE THE ANSWERS!

REPRESENTATIVES IN ALL PRINCIPAL CITIES

RMC

"You Can Rely On Rochester"

LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

ROCHESTER MANUFACTURING CO., INC.
113 ROCKWOOD STREET • ROCHESTER 10, N.Y.

© 1956 Rochester Manufacturing Co., Inc.



WIRED FASTER AND EASIER WITH CORROSION-RESISTANT ALCOA RIGID CONDUIT...

Every Alcoa plant built in the last ten years has an aluminum electrical distribution system... much of it enclosed in aluminum rigid conduit. And the same is true of Alcoa's 30-story headquarters building.

Other buildings include refineries, chemical plants, food plants, breweries.

Here are some of the reasons for the shift to aluminum rigid conduit:

- No stains or corrosion; no maintenance painting.
- Two-thirds lighter than steel; saves work, saves freight.
- Easier to cut, bend, thread, install; factory-applied, internally lubricated to facilitate pulling wires.
- Large sizes cost less than steel. When material costs are combined with labor and installation, aluminum is competitive in all sizes.
- Up to 20% less voltage drop.
- Nonsparking and Underwriters' Laboratories approved.

Fitting manufacturers make a full aluminum line—also available are thread cutting and joint compounds from Alcoa. Technical literature on all phases of installation may be obtained from any Alcoa sales office.

For full information . . . and a generous free sample . . . complete and mail the coupon below.

Aluminum Company of America
2324-K Alcoa Building
Pittsburgh 19, Pennsylvania

Please send literature on *Alcoa Aluminum Electrical Rigid Conduit* and a one-foot sample.

Name_____

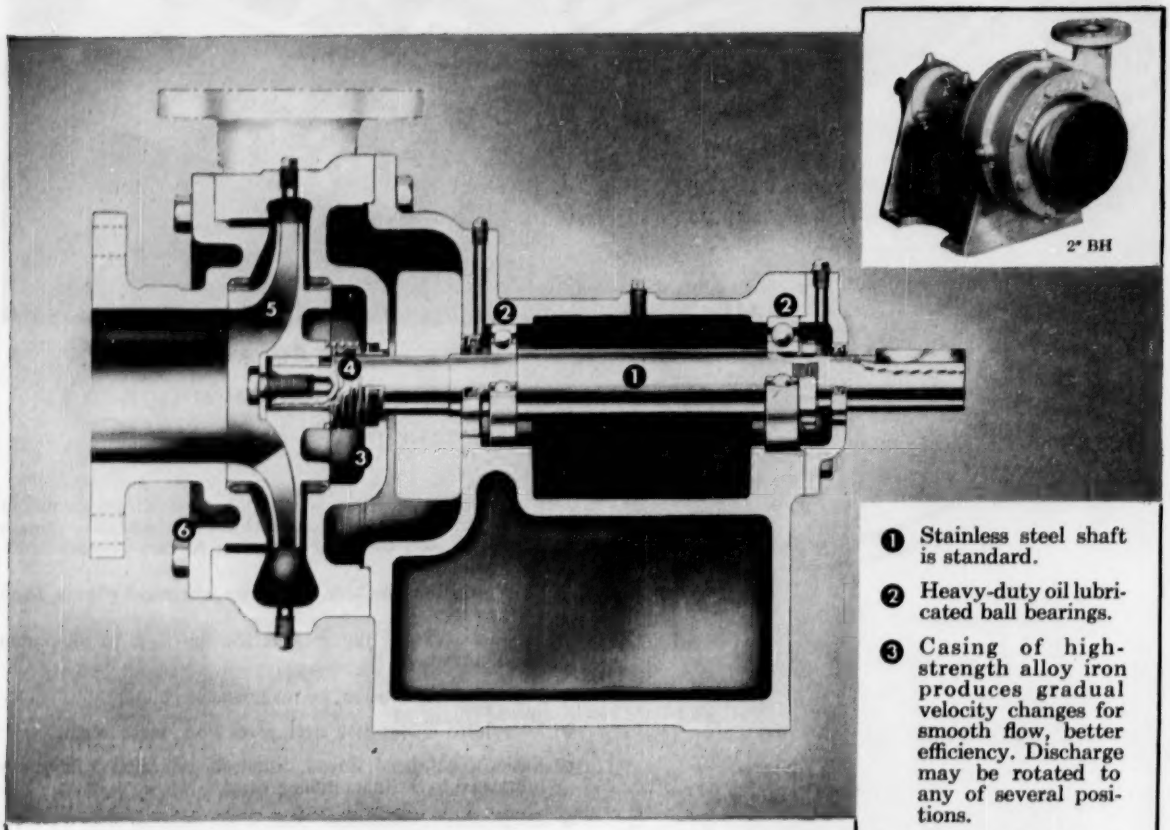
Title_____

Company_____

Address_____

City and State_____

New high speed, high head centrifugal pumps ... the Gardner-Denver BH line



1. Stainless steel shaft is standard.
2. Heavy-duty oil lubricated ball bearings.
3. Casing of high-strength alloy iron produces gradual velocity changes for smooth flow, better efficiency. Discharge may be rotated to any of several positions.
4. Mechanical seal for long life without attention.
5. Hydraulically balanced bronze impeller.
6. Casing cover readily removed for impeller inspection.

Quality inside improves useful output

BH PUMP RATINGS

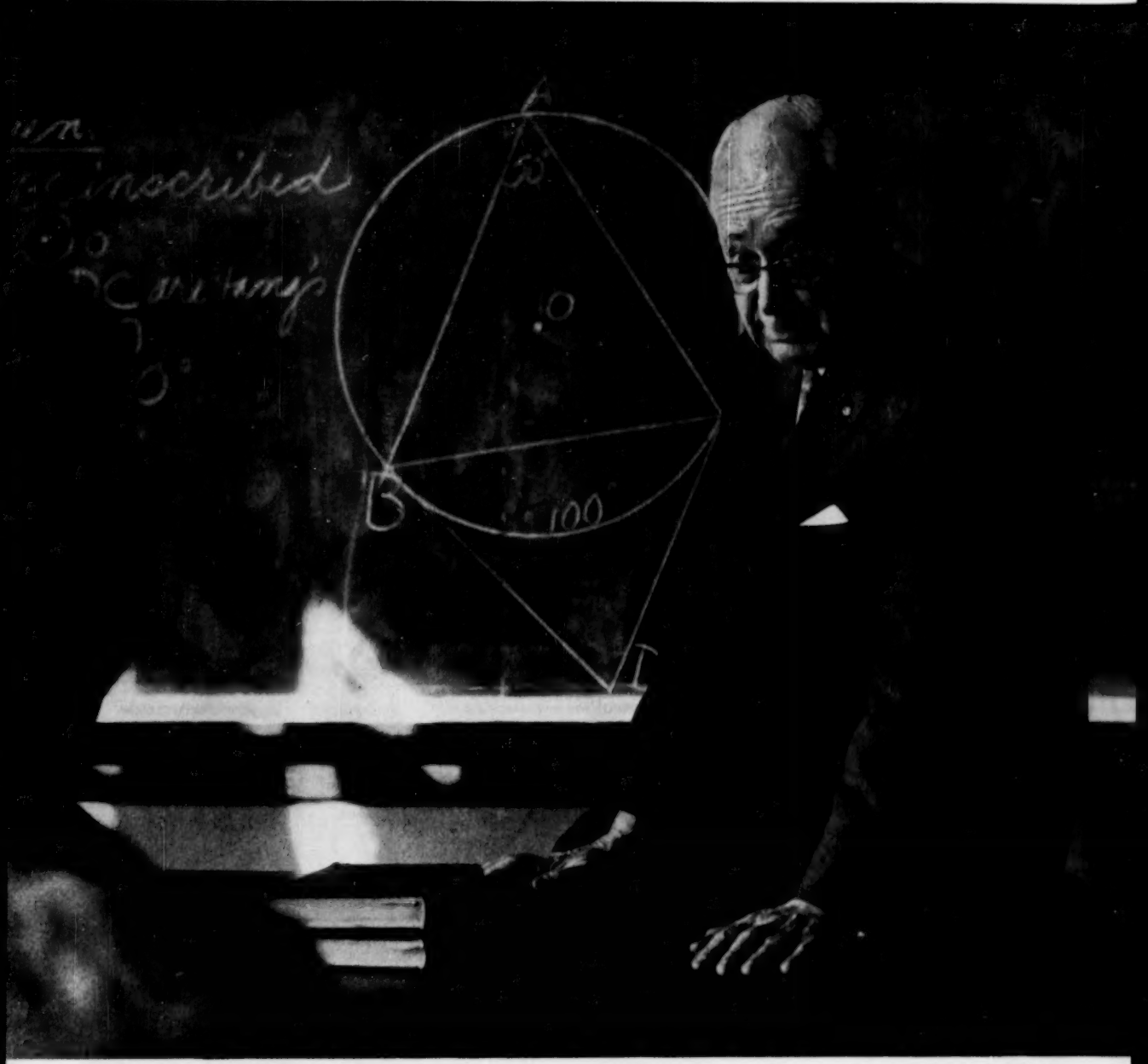
SIZE	HORSEPOWER	SPEED RANGE IN RPM	CAPACITY RANGE IN GPM
1"	1 to 10	1450 to 3460	55 to 150
1½"	1½ to 20	1450 to 3460	110 to 220
2"	2 to 25	1450 to 3460	170 to 440
3"	3 to 40	1450 to 3460	340 to 520

For complete information on these new Gardner-Denver BH centrifugal pumps, write for Bulletin 2-2e.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

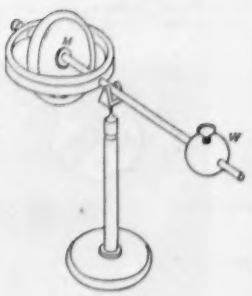


A Teacher affects eternity... he can never tell where his influence stops

. . . wrote historian Henry Brooks Adams—a truth that today demands universal recognition. America is losing to industry many of those best able to inspire and mold youthful minds—the dedicated teachers of high school subjects prerequisite to engineering training.

The value of a teacher's influence in a boy's selection of a career cannot be over-estimated, yet all too often the rewards of teaching are more spiritual than material. Compensation fitting the importance of their work can help keep teachers in their classrooms, where they prefer to be.

America gains every time teaching is chosen as a career. It also gains whenever a teacher finds it possible to remain in the profession.



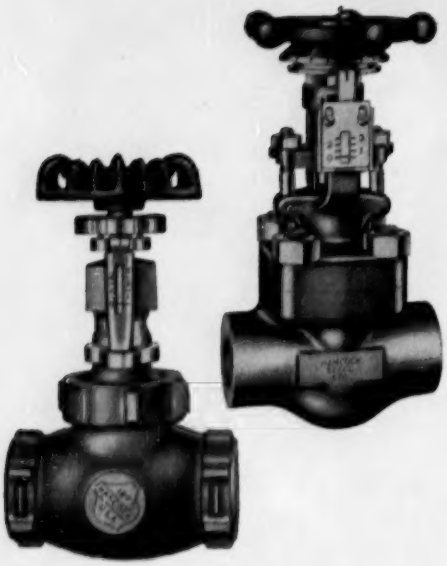
BECHTEL CORPORATION

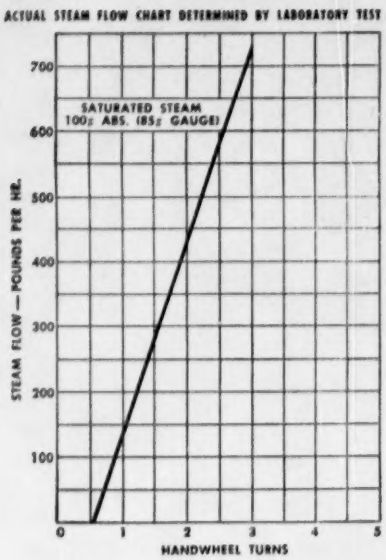
ENGINEERS AND BUILDERS FOR INDUSTRY

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HANCOCK "Flocontrol®" VALVES

- ✓ **Insure Uniform Quality Through Closer Control**
- ✓ **Save Steam and Fuel on Process Work**
- ✓ **Save Money by Cutting Maintenance**

Hancock "Flocontrol" Valves provide a 3-in-1 design that combines variable orifice, shut-off and index. The valve opening can be set to within one-tenth of a turn of the handwheel. The micrometer dial and pointer make it easy to duplicate any desired setting instantly.

Each valve has a scientifically designed V-port valve disc that insures proportional flow throughout the entire lift of the stem. Straight line flow with separate shut-off seating surface removed from the controlling V-ports eliminates the need for a separate shut-off valve.

Hancock "Flocontrol" Valves are available in Bronze and Steel to meet specific requirements. All are rugged valves, designed and constructed to provide the *economy of quality* so essential to assure top performance in the most demanding services.

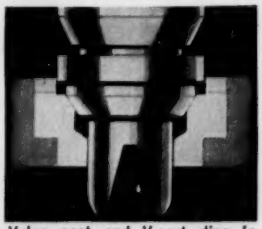
Hancock Bronze "Flocontrol" Valves. *Types:* Globe and Angle. *Sizes:* ¼" through 2". *Connections:* Screwed Ends. "500 Brinell" Stainless Steel Seats and Discs. 150# Series for all pressures up to 150 psi at 358° F. 300# Series for all pressures up to 300 psi at 550° F.

Hancock Forged Steel "Flocontrol" Valves. *Types:* Globe and Angle. Renewable Hard-Faced Stainless Steel Seats. "500 Brinell" Stainless Steel Discs. *Connections:* Screwed, Socket Weld and Flanged Ends. *Sizes:* Screwed and Socket Weld Valves—¼" through 2". Flanged Valves—½" through 2". *Screwed and Socket Weld Valves:* For all pressures up to 600 psi at 910° F. O.W.G.—2000 psi at 100° F. *Flanged Valves:* For all pressures up to 600 psi at 850° F. O.W.G.—1440 psi at 100° F.

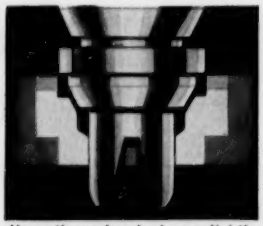
Hancock Cast Steel "Flocontrol" Valves. Globe Type with Screwed Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½" and 3". *Connections:* Screwed and Flanged Ends. For all pressures up to 395 psi at 775° F. O.W.G. —720 psi at 100° F.

Hancock Cast Steel "Flocontrol" Valves. Globe type with Bolted Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½", 3" and 4". *Connections:* Flanged Ends. 300# Series for all pressures up to 395 psi at 775° F. O.W.G.—720 psi at 100°F. 600# Series for all pressures up to 800 psi at 775° F. O.W.G.—1440 psi at 100° F.

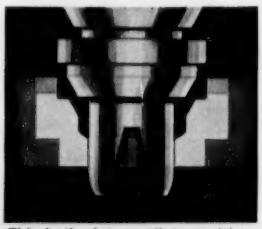
HANCOCK "FLOCONTROL" VALVES OPERATE LIKE THIS . . .



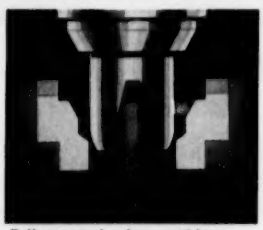
Valve seat and V-port disc in fully closed position. Pressure pushes upward under the disc. Note that the shut-off seating surface is completely removed and separate from the flow-controlling V-ports.



Here the valve is in a slightly opened position. The V-port disc is permitting a measured flow of the media.



This is the intermediate position. Note that the V-port disc now permits a proportionally greater flow of the media.



Fully opened valve provides maximum flow. The special micrometer dial and pointer permit any open position to be duplicated accurately.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. Let him help you select the right Hancock "Flocontrol" Valves for your needs. You can depend on him for fast delivery from local stocks.

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A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" and 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

Magnetic ideas from ERIEZ



ATTRACTIVE UNDERWATER ATTRACTION! This attractive Miss is demonstrating the Magnetic Power of an Eriez HI-POWR Magnet. This idea of herculean strength (even under water) and permanent dependability is applied in practical ways in industry, where Eriez HI-POWR magnetic separators are used to remove tramp iron from processing lines before it can cause fires, machinery damage or product contamination. Eriez HI-POWR Magnets are also used to convey, control and hold metals, from small parts to large steel sheets and pipe. They are easily installed on new or existing equipment, and offer many automated materials handling advantages. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments; magnetic power is guaranteed forever. The first cost is the only cost.*



PIPELINE TRAP REMOVES IRON CONTAMINANTS FROM SLURRY! An Eriez Model B Ferrotrap (Pipeline trap) in use at B. T. Babbitt, Inc., Albany, New York, is trapping about 10 lbs. a month of tramp iron and scale. The unit is installed in a tank car unloading line which handles Alkyl-Aryl-Sulfonate slurry, a substance used in the manufacture of the company's product—Babbitt Built Detergent. The trap performs a dual function: it protects equipment from ferrous damage and results in better quality control. Model B Ferrotrap has a stainless steel casing, with threaded fittings to 2", 3" or 4" pipelines. Attached to the removable cover of the unit are multiple stainless steel rods with a lifetime-powered Alnico V magnet within each rod. These rods break up the flow of liquid into finer flows, which pass around the rods depositing iron or iron fines on the magnetic elements. This new design trap offers up to 400% more magnetic area than previous traps and can be installed in any position. Model B provides the ultimate in protection against ferrous contamination of liquids flowing through lines and is also available in a sanitary model for lines handling foods, beverages, drugs, etc.

Eriez HI-VI electro-permanent magnetic vibratory equipment

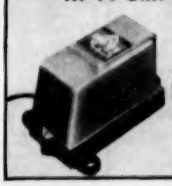
Here's the first complete line of electro-permanent magnetic vibratory equipment that operates at 3600 CPM directly off an AC line. Just plug the units in—*no rectifier needed!* Eriez HI-VI units provide greater vibratory output with less power consumption. Less maintenance; lower installation costs. Lifetime-powered Alnico V magnetic element produces exclusive "double action" drive for greater productivity.

HI-VI Vibratory Feeders

convey, spread, agitate, cool, blend, mix, etc. Give an accurate, controlled feed to bulk materials.



HI-VI Unit (Bin) Vibrators



self-adjusting units keep bulk materials pouring evenly and smoothly through hoppers, bins, chutes, ducts, etc. Eliminate pile-ups, bridging, sticking, etc.

PIPELINE TRAP FINDS FINES IN PAINT LINES. At the Rinshed-Mason Co., Detroit, Mich., an Eriez Model L Ferrotrap (Pipeline trap) is used to protect automotive paints from ferrous contamination. The permanent-powered Ferrotrap is located directly at the outlet of a paint grinding mill where it traps minute particles of steel chipped off the grinding balls. Sometimes these chips are only a few thousandths of an inch in size, but the powerful action of the Alnico V magnetic element traps and holds them until the accumulated iron is removed. The Model L Ferrotrap consists of a long magnetic element, in an all-bronze housing with two openings in the upper side for attachment to pipelines of 1/2" to 2" diameter. Liquids flowing through the line come into contact with the magnetic bar, and deposit their iron contamination. To clean the unit, one end is unscrewed and the magnetic bar is removed with it and wiped with a rag. Model L provides dependable, economical protection against ferrous contamination.

ERIEZ HI-POWR MAGNETIC SEPARATORS

ERIEZ HI-VI VIBRATORY EQUIPMENT

ERIEZ . . . pioneers and world's largest producer of Permanent Non-Electric Magnetic Equipment for industry have three major product lines to serve your needs.

HI-POWR MAGNETIC SEPARATORS (like those shown above) to remove unwanted iron from processing lines.

HI-POWR MAGNETIC AUTOMATION UNITS to handle untold materials handling problems . . . convey, transfer, control, elevate, re-position, etc., ferrous materials or parts during many manufacturing processes.

And

HI-VI VIBRATORY EQUIPMENT to move and accurately feed bulk materials. ERIEZ "Magnetic Ideas" can help you. Eriez' factory-trained field men, backed by Eriez extensive laboratory and engineering know-how, will be happy to study your particular problem, make a plant survey, and offer helpful "Magnetic Ideas."

WRITE FOR BIG NEW COMPREHENSIVE CATALOG OF ERIEZ ENTIRE LINE TODAY . . . state your particular problem and we'll try to assist. Eriez Manufacturing Company, 74X Magnet Drive, Erie, Pa.

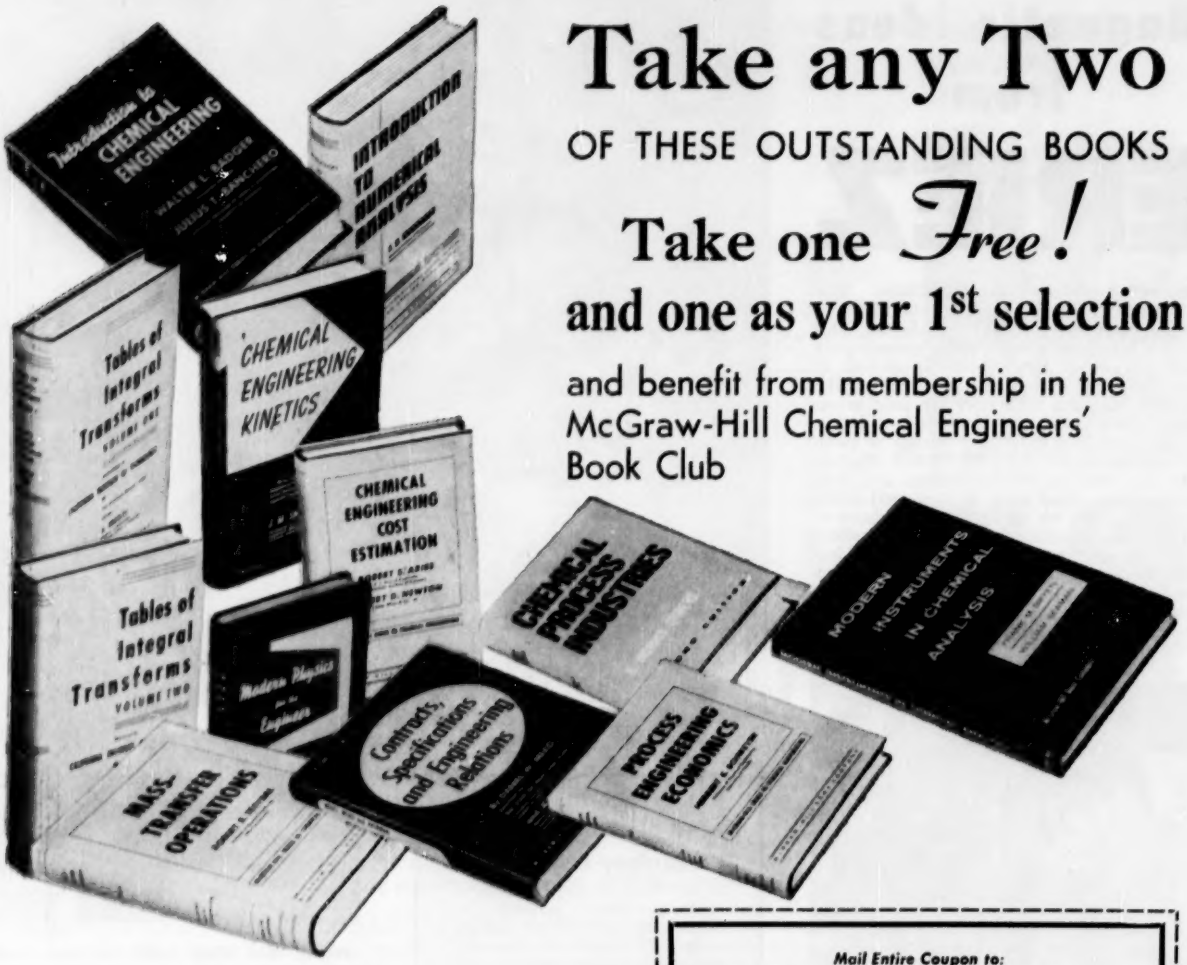
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From this point on, the choice is yours. If you want the main selection you do nothing; the book will be mailed to you. If you want an alternate selection or if you want no book at all for that two-month period, you notify the Club by returning the form and postage-paid envelope enclosed with your *Bulletin*.

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Telescoping joints with multiple slots permit infinite adjustability up to 12 inches when other than standard lengths are required. Standard elbows, T's and X's telescope up to 6 inches!

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Faster to install • Above photo of fixed joint shows simplicity of design—symmetrical ends—less bars per phase—fewer connections—outward-facing captive bolts



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Totally enclosed for safety —at no price premium. No de-rating necessary. Square D's design eliminates need for ventilation

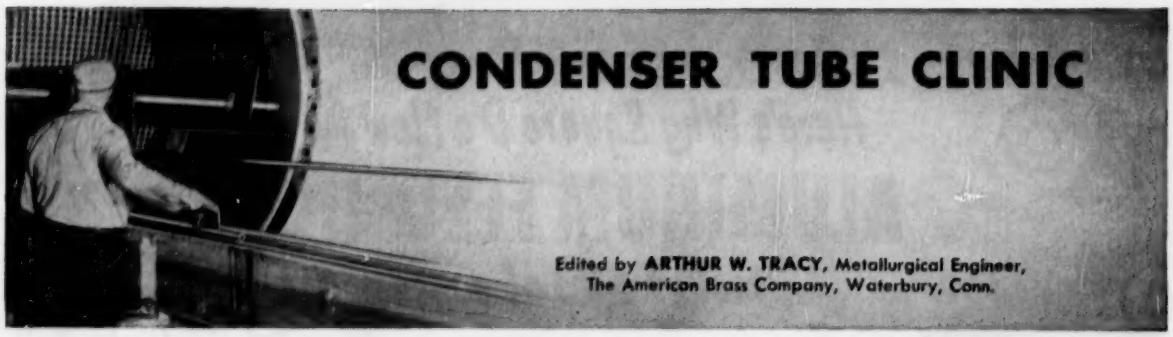
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CONDENSER TUBE CLINIC

Edited by **ARTHUR W. TRACY**, Metallurgical Engineer,
The American Brass Company, Waterbury, Conn.

Some operating factors that affect tube life

COMPOSITION OF THE COOLING WATER

The quantities of cooling water used in condensers preclude any treatment to make the water less corrosive, except where the water is recirculated. Economics often does not permit locating a power plant at a site where water is not corrosive.

In general, however, plants located inland will have relatively noncorrosive cooling water. Plants situated on tidewater will have corrosion problems, especially if the water is polluted with industrial or domestic sewage and conditions are such that organic matter in the sewage can ferment under anaerobic conditions, with the consequent formation of sulfides. Water in an enclosed harbor or dead-end channel, where the water is more or less stagnant, is particularly subject to infestation by anaerobic bacteria.

PREVENTIVE MAINTENANCE

Frequent cleaning of tubes to remove slimes containing bacteria and the simultaneous removal of sulfide scales will increase tube life. Chlorination of polluted water at frequent intervals, or periodically filling the water spaces in the condenser with chlorine gas, will not only remove the slimes but may also aid in breaking down the unwanted sulfide films which have formed on the inner walls of the tubes.

In some cases, it may be possible to dredge the channel bottom near the water intake to remove accumulations of decaying vegetable matter.



An American Brass Company Chemist uses Photo-Electric Colorimeter to analyze cooling water samples as a basis for tube alloy selection.

MEDIA BEING COOLED OR CONDENSED

It is not usually possible to change the corrosive properties of products being handled in the process industries. The venting of noncondensable gases, however, will markedly increase tube life. This is particularly true on the steam side of boiler feed-water heaters and other steam-heated equipment where accumulations of oxygen, carbon dioxide, and ammonia can cause rapid failure of condenser tubes.

TEMPERATURE

The corrosion rate of metals usually increases with increasing temperature. This is a problem particularly in refinery condensers where water velocities are often relatively low and the water temperature is relatively high. At low water velocities, the formation of gas bubbles on the water side of a tube can initiate pitting which may continue even after the bubble has disappeared. In such cases, a judicious increase in water velocity will insure longer tube life, provided the velocity is not increased to a point where impingement corrosion can occur.

Many believe that condenser tubes put in service in the winter when water is cool will last longer than those started in the summer. A more protective film of corrosion products forms on the tube wall in winter, probably because the water is freer of sulfides.

TECHNICAL HELP IN SELECTING TUBES

Your situation may require special consideration and analysis. We are always ready to help and advise in the selection of the right alloy to give best service. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8786

ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers Made by The American Brass Company

PHYSICAL PROPERTIES OF ANACONDA CONDENSER TUBES*

ALLOY	Tensile Strength, psi	Yield Strength at .5% Elongation Under Load, psi	Elongation in 2", %	Rockwell Hardness, B Scale	Density, Lb. per Cu. In.	Thermal Conductivity, B.T.U./Sq. Ft./In./Hr./°F. at 68° F.	Average Coefficient of Linear Thermal Expansion per °F. (77-572 F.)
Arsenical Admiralty-439	52,000	22,000	60	6-45	0.308	768	.0000112
Ambralay-927	60,000	27,000	55	35-65	0.301	696	.0000108
Ambralay-901	60,000	30,000	60	30-60	0.295	552	.0000099
Cupro Nickel, 30%-702	55,000	22,000	50	30-60	0.323	204	.0000090
Cupro-Nickel, 10%-755							
Light Annealed	44,000	22,000	46	25	0.323	314	.0000093
Light Drawn	60,000	57,000	15	68			
Red Brass-24	42,000	15,000	50	0-30	0.316	1104	.0000104
Ambronze-421	46,000	20,000	55	0-30	0.316	830	.0000102
Phosphorized Arsenical Copper-108							
Light Drawn	40,000	35,000	20	20-50	0.323	1344	.0000098
Hard Drawn	54,000	50,000	8	50-70			
Phosphorized Copper-103							
Light Drawn	40,000	35,000	20	20-50	0.323	2364	.0000098
Hard Drawn	54,000	50,000	8	50-70			

*Note: The above values are approximate and should not be used for specification purposes. *Light annealed except as noted.*

new

Technical Digest on Commercial-Grade Zirconium

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CAMBRIDGE 42, MASSACHUSETTS

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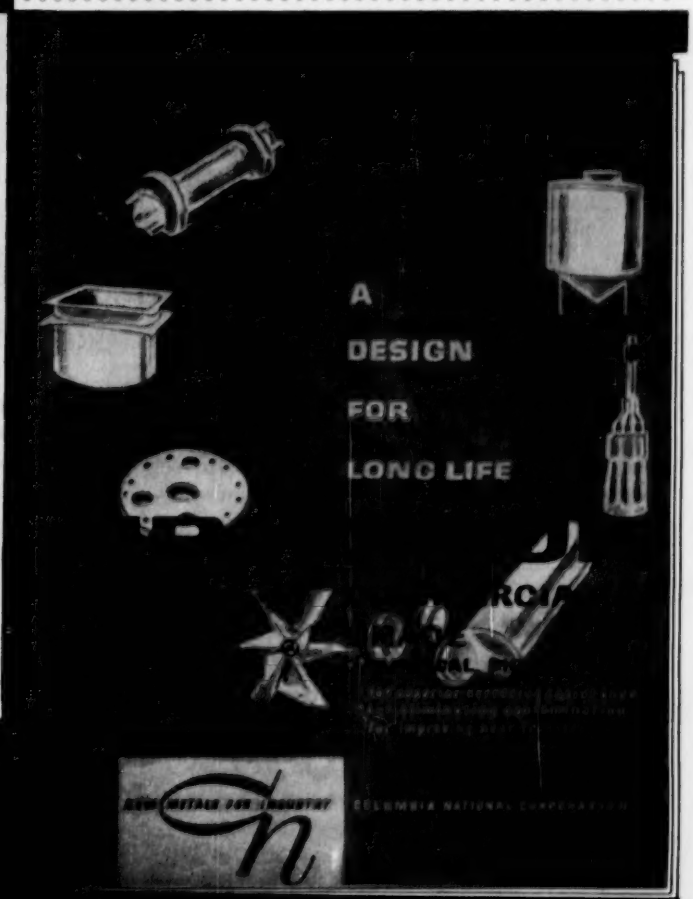
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Jointly owned by Columbia-Southern Chemical Corp. and National Research Corporation

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why wonder?



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And that's not all. With just one thermostatically-operated moving part, there's nothing to get out of order, nothing to go wrong. Nicholson means continuous operation of your steam-using equipment . . . no downtime from trap failure.

- **high air-venting capacity . . . for faster warmup of equipment.**
- **powerful valve action . . . no mechanical linkages to cause trouble.**
- **small and lightweight . . . easy to pipe and support.**

So, to get a trap that's service-tested, and loaded with operating features, specify Nicholson. W. H. NICHOLSON AND COMPANY, 14 OREGON ST., WILKES-BARRE, PA., *Sales and Engineering offices in 98 principal cities.*

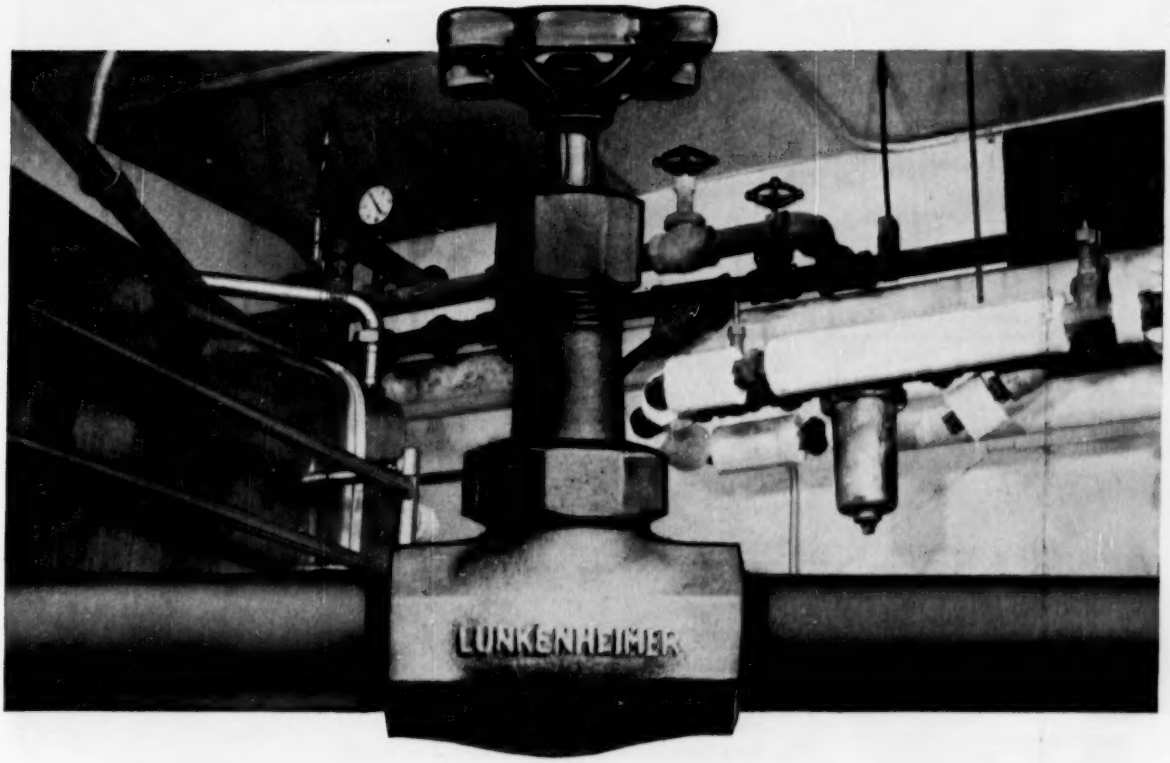


Write for Bulletin 1055

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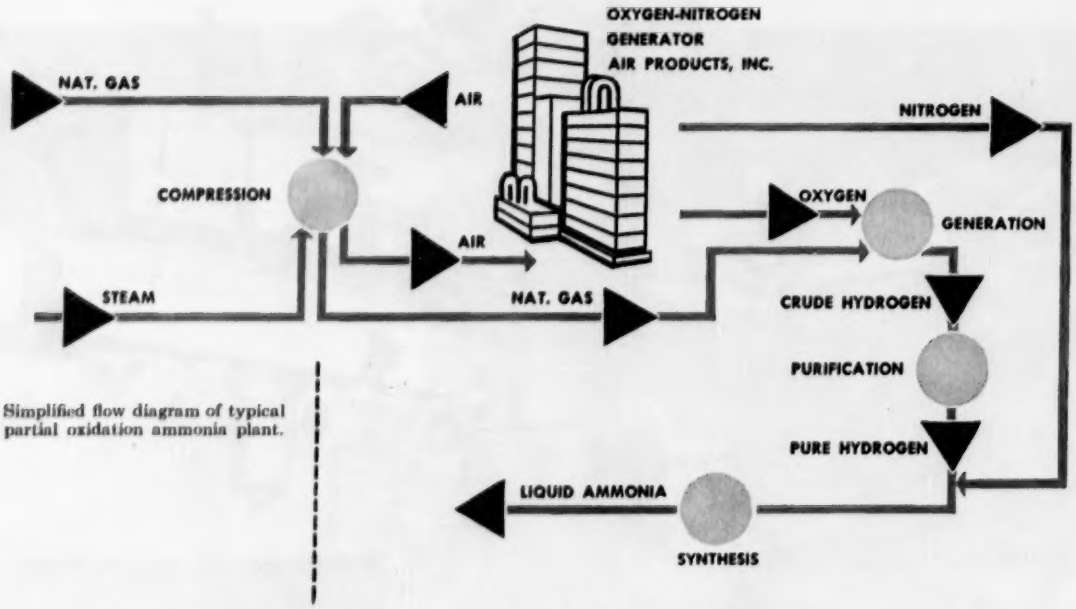
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Maximum "On-Stream" Time Lowers Ammonia Cost/Ton



Simplified flow diagram of typical partial oxidation ammonia plant.

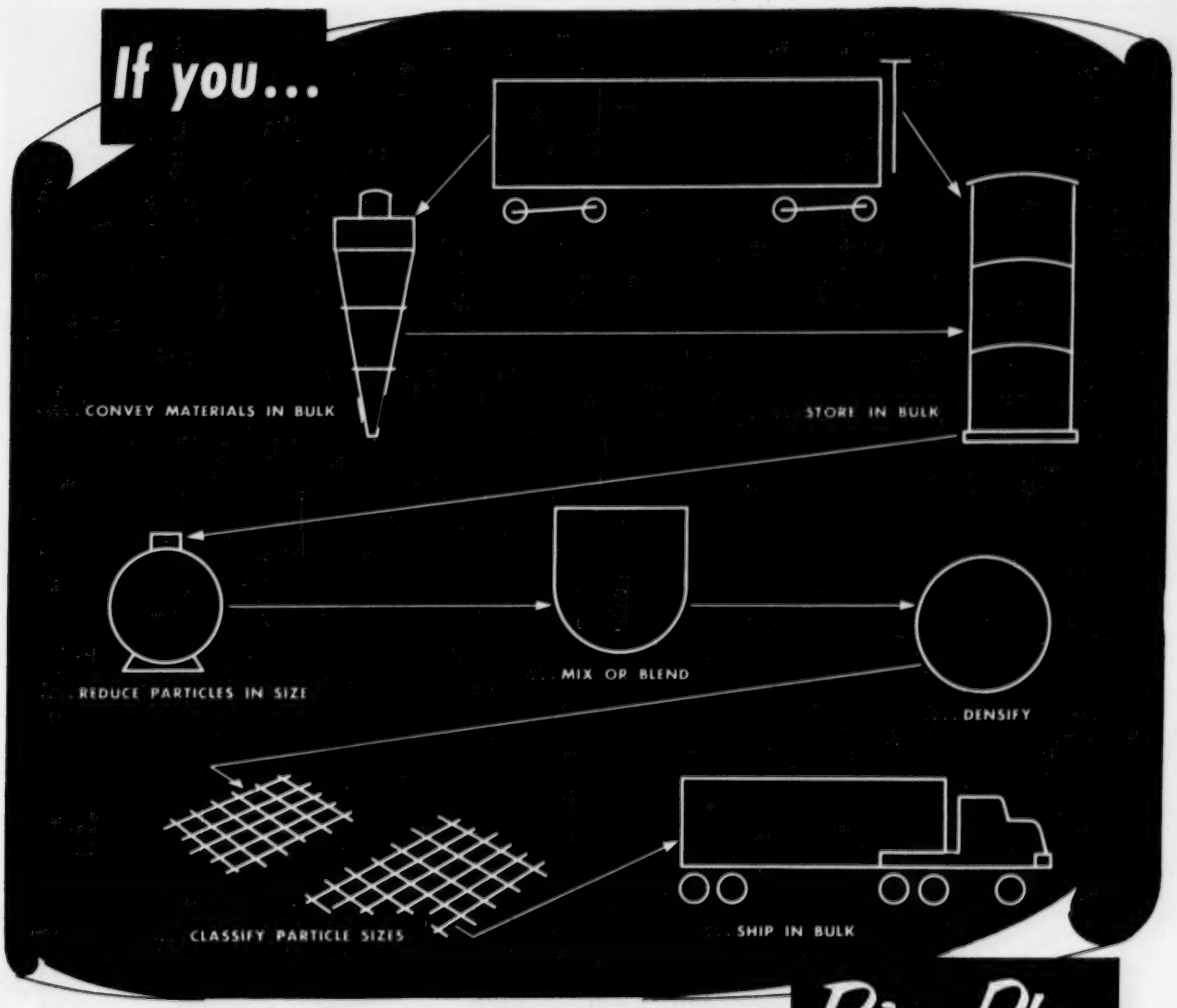
...using Air Products Oxygen-Nitrogen Plant and Nitrogen Wash Process

Thanks to an increase in the amount of time that ammonia plants can spend "on stream", the dollar cost per ton is down. The increase is due to the dependability of Air Products low temperature air distillation, liquid oxygen pumping and nitrogen wash systems. Greater dependability means less down-time and increased production without increase in cost. One ammonia plant's oxygen-nitrogen generator, for example, set a record of 14 consecutive months without shutdown... permitting continuous production of ammonia for the entire period.

Air Products are specialists in processing low molecular weight materials at cryogenic temperatures. Our research and engineering activities, for ourselves as well as others, have developed a wealth of unique data, processes and equipment that may well point the way to profitable opportunities for you.

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Sprout-Waldron installations achieve a degree of specific fitness that is unusual in industry.

This success is due to a unique application of engineering know-how and imagination to the solving of difficult processing problems . . . PLUS . . . wide selections of virtually all types of processing equipment ...PLUS...an ability to "adaptioneer" machines to meet individual needs...PLUS... manufacturing facilities that include fabricating, machining, custom founding, woodworking, and laboratory testing.

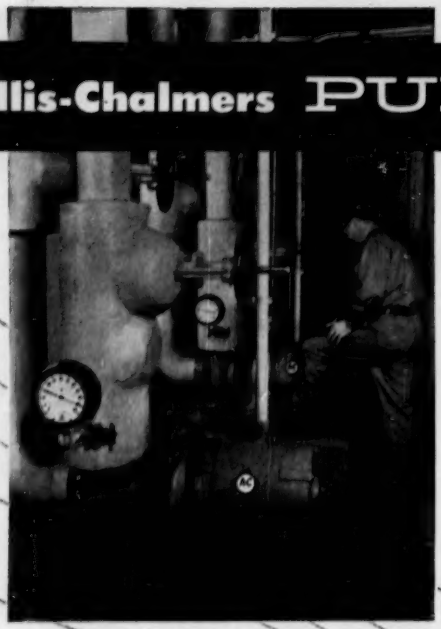
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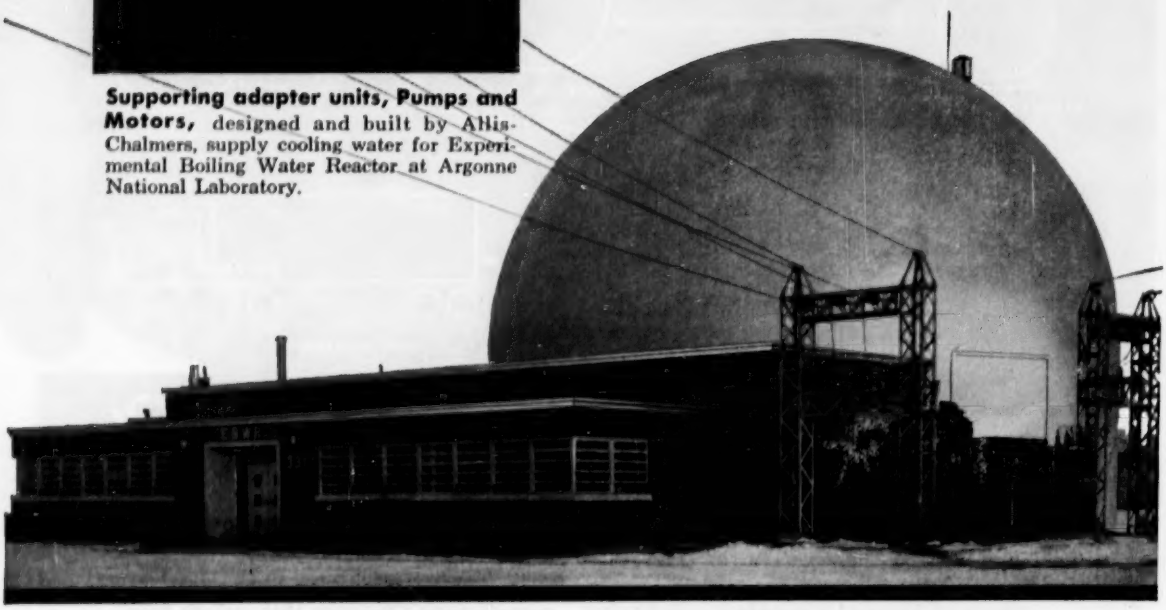
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Supporting adapter units, Pumps and Motors, designed and built by Allis-Chalmers, supply cooling water for Experimental Boiling Water Reactor at Argonne National Laboratory.

...help create Nuclear Power at Argonne National Laboratory



THIS is the first commercial-type power plant in the United States to produce usable quantities of electric power from nuclear fuels.

Designed for experimental use by Argonne National Laboratory, it will help determine the potentials of the boiling water reactor for large-scale application.

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Experienced A-C engineers can help *you* select exactly the right centrifugal pumps for your needs. You'll get the proper materials, appropriate packing or sealing arrangement, high hydraulic efficiency . . . and *real* dependability. Contact your A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

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#6 MIKRO-Atomizer and MIKRO-Collector handling colors at Toms River, New Jersey plant of Toms River-Cincinnati Chemical Company.

● The history of equipment purchases at Toms River-Cincinnati Chemical Corporation offers an outstanding example of time-tested satisfaction with MIKRO-D Pulverizing and Dust-Collecting equipment. Since 1928, the number of installations in their various plants has increased almost step-by-step with the steady growth of this foremost chemical firm. Today, you'll find a roster of MIKRO-D equipment ranging from laboratory-sized units to mills that process tons per hour of dyes and dyestuff materials, every hour of the day.

We'll gladly make recommendations regarding the product you are grinding. Send us a sample and specifications. You'll discover how MIKRO-D—now serving chemical processing plants throughout the world—can insure a more profitable operation, and a product that meets the highest standards of quality.

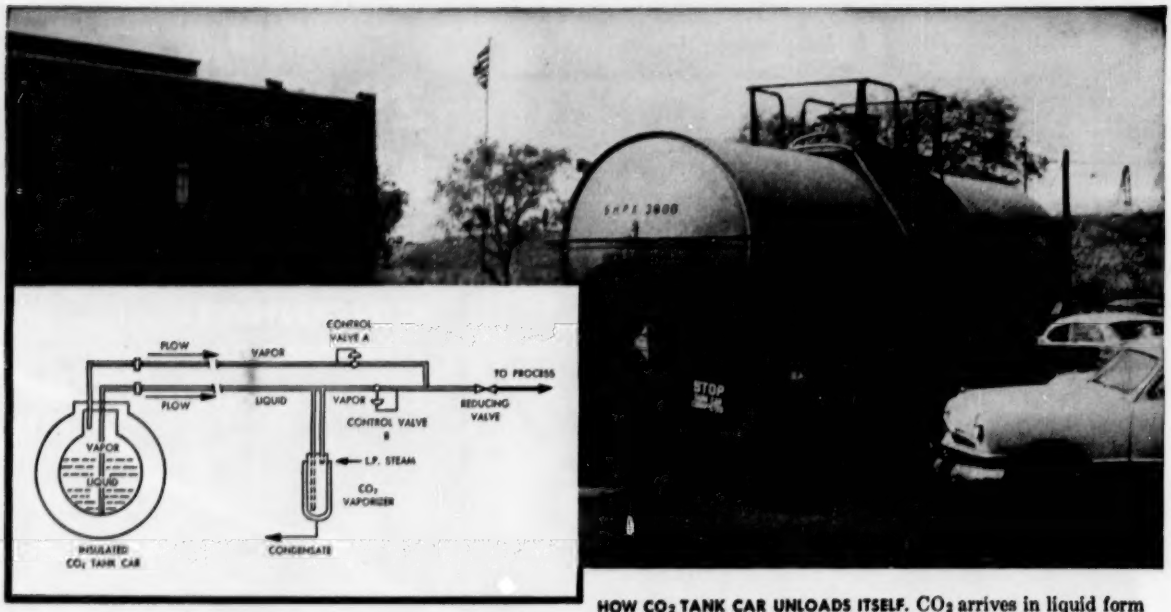
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METALS DISINTEGRATING COMPANY, INC.

55 Chatham Road • Summit, New Jersey

Genuine Mikro-D Replacement Parts available from large stock within 48 hours.



HOW CO_2 TANK CAR UNLOADS ITSELF. CO_2 arrives in liquid form with vapor pressure of less than 300 lbs. psig. Diagram at left shows how automatic unloading system sends CO_2 vapor directly to process. (Control valve A is open when line pressure is 220 lbs. psig or higher. Valve B is open below 200 lbs. psig.) Photo courtesy of Pfister Chemical Works in Ridgefield, New Jersey.

CO_2 goes directly from tank car to process...

- **eliminates expensive storage and refrigeration**
- **no need to handle CO_2 cylinders or convert dry ice**
- **cuts down maintenance and upkeep**
- **reclaims valuable plant space or land**
- **assures constant CO_2 flow that matches demand**

Here's a remarkable, new, exclusive method of handling CO_2 shipments that may prove profitable to many users of carbon dioxide. It's Olin Mathieson's patented *Direct Unloading System—CO_2*, in which CO_2 vapor flows directly from special, insulated tank cars to your process ...at rates of from 6 to 1500 lbs. per hour, varying directly with the demand.

This new system bypasses intermediate steps such as storage in refrigerated tanks, handling of cylinders, or converting dry ice, along with the expensive, extensive facilities that these require.

Completely automatic, this method requires no power—only a small, low-pressure steam line. The distance from spur to plant is generally immaterial. Olin Mathieson installs and maintains the system and leases the cars to you so that no demurrage occurs.

Direct unloading prevents any venting as long as CO_2 is used in process, while an uninterrupted flow is maintained by connecting the coupling stations in parallel along the spur. This allows a balanced switchover from emptying tank cars to full ones.

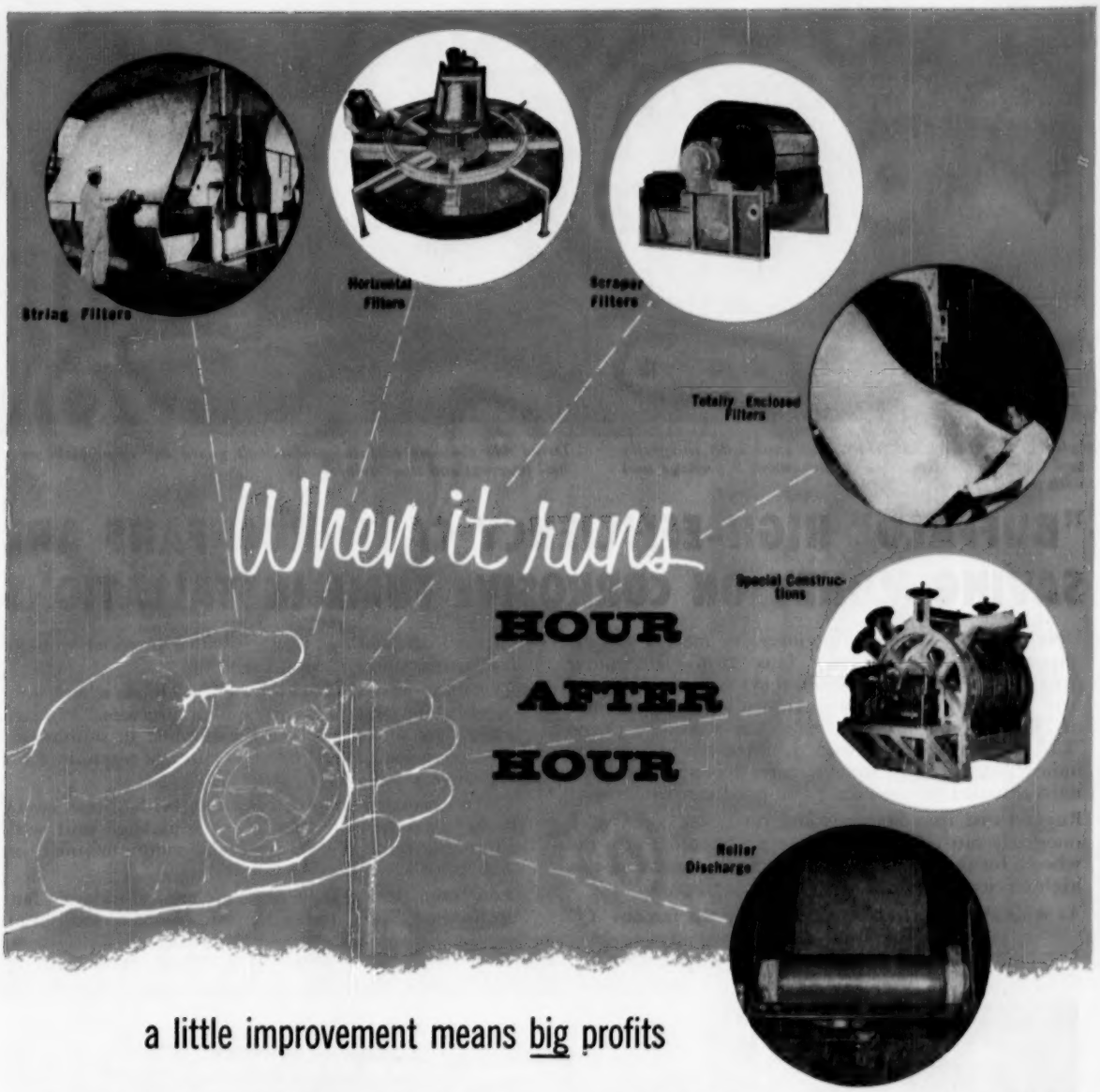
On-time shipments are assured by Olin Mathieson's CO_2 plant at Saltville, Va.,—the world's largest—and by Olin Mathieson's fleet of 24- and 30-ton insulated tank cars.

Direct Unloading System—CO_2 can be installed in a matter of weeks. Why not contact Olin Mathieson soon to see whether it can be profitably adapted to your operation.

4738

MATHIESON

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION · BALTIMORE 3, MD.



a little improvement means big profits

That's particularly true in filtration, where a few points higher recovery of solubles . . . or 5% less moisture . . . or 1% less impurities . . . soon pays back the entire cost of the filter. There's only one way to get the last ounce of efficiency: *custom designed* filtration . . . a FEinc specialty for 35 years.

FEinc offers you an almost infinite variety of filter types, discharge methods, valve designs, cake washing systems, dewatering devices, internal drainline arrangements, drainage surfaces, enclosures, sizes, speeds and materials of construction.

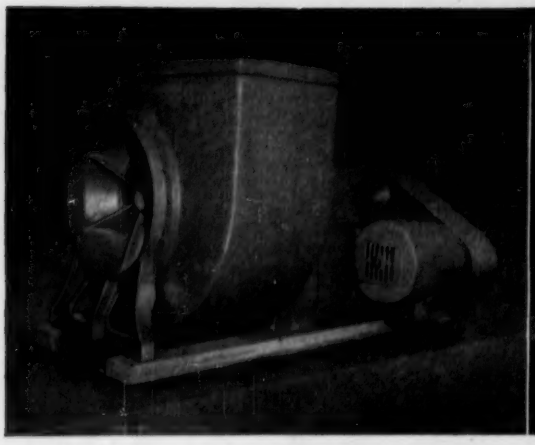
The cost? FEinc's custom engineering costs no more than ordinary filters . . . and rewards you handsomely day after day, year after year.

Write today for Bulletins or ask for free performance studies

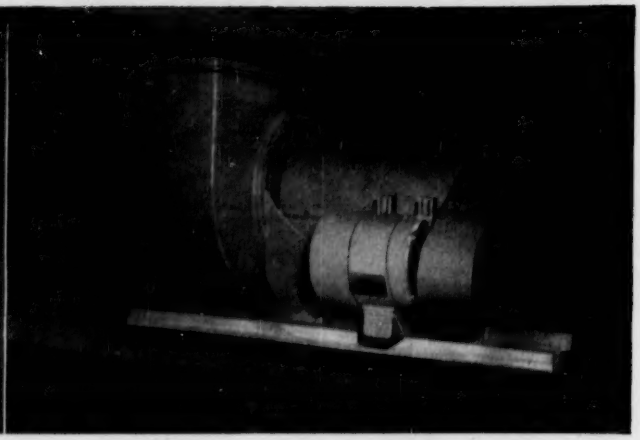
FEinc
FOR A BIGGER YIELD

FILTRATION ENGINEERS, INC.
SUBSIDIARY OF AMERICAN MACHINE & METALS, INC.
155 Oraton Street, Newark 4, N. J.

Custom designed continuous filtration



Inlet side showing cast iron inlet cone with integrally cast guide vanes. Fan is an Arrangement 9 package unit with monel wheel.



Drive side showing enclosed motor, belt guard and rain shield over ball bearings and shaft drive.

"BUFFALO" HIGH-EFFICIENCY CAST IRON FANS ARE SAVING MONEY ON CORROSIVE FUME INSTALLATIONS

Developed by "Buffalo" engineers to meet a specific request for high efficiency fans to operate under extremely corrosive condition, these fans combine cast iron durability with the well-known high performance of "Buffalo" Limit-Load® Fans. These No. 2½ Type "LL" Fans are popular with the chemical and process industries; one large manufacturer having over 1,000 units installed on chemical fume hood exhaust.

Rugged cast iron housings and cast inlet cones with integrally cast inlet vanes, guide air smoothly into the wheels, for the low-turbulence air flow inherent in this high efficiency design.

As with all "Buffalo" Fans, these have the famous "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

These fans have the backward curved blade wheel, non-overloading, regardless of system pressure. Standard wheels are monel but can be supplied in stainless or protective coated steel or of Everdur or aluminum for explosive atmospheres.

Three arrangements are available: with direct motor drive, separate belt drive or as a package unit with adjustable pitch V-belt drive and motor mounted on adjustable base rails.

Your inquiries on these rugged chemical-industry fans are invited. Write today on your company letterhead.



Roof exhaust installation at a major chemical and dye plant.

"Buffalo"

BUFFALO FORGE COMPANY

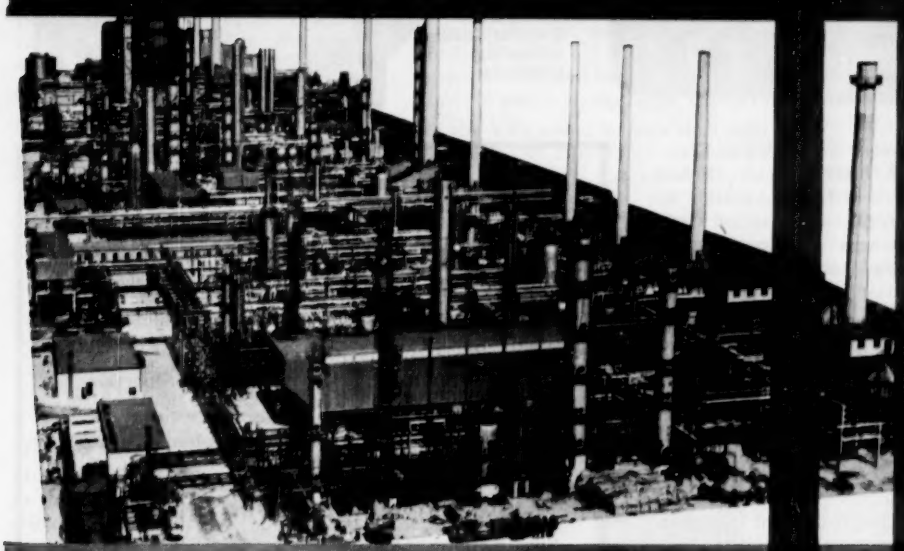
BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

TIDEWATER—builds for the future

Tidewater Oil Company's new refinery near Wilmington, Delaware, is the largest refinery ever built as a single project. It has a total capacity of 130,000 barrels per day. Its crude unit, Orthoflow fluid catalytic cracking unit, fluid coker and 45,000 BPD Houdriformer are the largest units of their kind ever built. Supplementary facilities are in scale with the vast productive capacity of this "Refinery of the Future."



CATALYTIC—maintenance for the future

Catalytic's record in maintenance of refineries and other industrial plants has won it the maintenance contract for this gigantic new Tidewater enterprise. It assures Tidewater Oil Company of professional engineering type service that works in coordination with Tidewater's own staff. It means a minimum, highly productive, flexible force on the job only as required . . . with qualified mechanics available for turn-around periods.

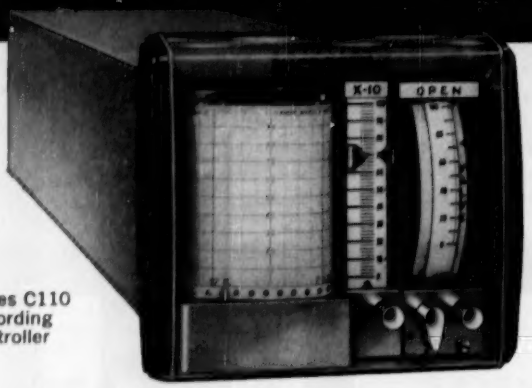
Catalytic's contract maintenance service means more profits and less operating expense. Write for information on Catalytic Contract Maintenance.

CATALYTIC
Construction Company

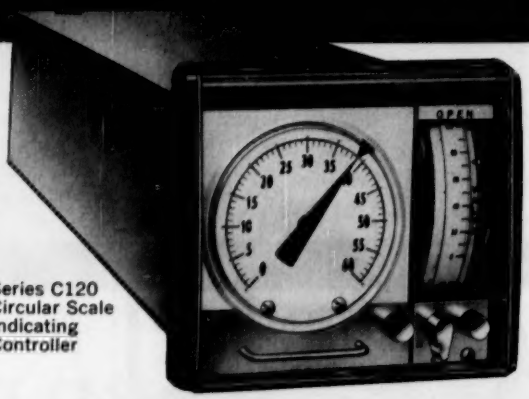
Philadelphia 2, Pennsylvania
Toledo, Ohio
In Canada: Catalytic Construction of Canada, Limited; Sarnia, Ontario; Toronto, Ontario; Montreal, Quebec

Catalytic On-Time . . . On-Budget Services
For the metallurgical, chemical, petrochemical and oil refining industries: Project Analysis; Process Development; Process Design; Economic Studies; Engineering; Procurement; Construction; Plant Operation.

NEW TRANSISTORIZED ELECTRONIC CONTROLLERS Interchangeable for complete versatility



Series C110
Recording
Controller



Series C120
Circular Scale
Indicating
Controller

The new 'American-Microsen' Series C100 Electronic Controllers can be interchanged at the panelboard in seconds. A recording controller to an indicating type . . . a proportional-action controller to proportional-plus-reset . . . slow reset to fast reset – any of these replacements is quickly made by pulling one unit out and plugging in the other.

The controller settings of the 'American-Microsen' System are all calibrated and repeatable. When a controller station is replaced, the proportional, reset and rate settings can be made in advance so the process is on control the instant the changeover is completed. No playing around to tune in the control.

When the process is on manual control during a replacement operation, the controller station stays in balance with the actual valve position. Thus the process can be changed back to automatic control without "bumping" or upset. A unique feature of the 'American-Microsen' System eliminates any "balance" or "seal" position between manual and automatic.

These are but a few of the many functional advantages of the new 'American-Microsen' Electronic Control System. Join the many satisfied users of this new approach to process control. Make certain you have the better control and simplified servicing so essential to higher product quality and greater operating economy. Arrange for a meeting with one of our sales engineers to determine the best equipment for your service. *Write for Bulletin RC100.*

Controller Performs These Functions

Measures input signal from transmitter and records or indicates in terms of the measured variable — pressure, temperature, flow, etc. (The Series C110 records on a 3-inch wide strip chart, the Series C120 indicates on a 4-inch diameter scale.)

Provides means of setting the desired value of the measured variable (set point) and compares actual value with desired value.

Transmits control signal, incorporating proportional, reset, and/or rate actions to operate final control element.

Provides means to operate control element manually with simple switch and manual knob.

Ultra-Modern Features Provided

All functions of recording (or indication), controlling (proportional, reset, and/or rate), and manual valve operation *in a single housing.*

Transistorized controller station for ultimate reliability and long service life.

Printed circuitry and miniaturized components for space-saving simplicity.

Plug-in units for complete interchangeability and ease of maintenance.

Ratio, cascade, and other similar control arrangements, using standard instruments.

Direct bumpless transfer from manual to automatic control with no intermediate position.

DC signals of 1.0 to 5.0 milliamperes for instantaneous distance transmission up to 30 miles.

Controllers are compatible with any unit of other manufacture using the standard 1 to 5 milliampere DC signal.

MANNING, MAXWELL & MOORE, INC.

MAXWELL MANNING & MOORE INC. M M & M TRADE MARK

INDUSTRIAL CONTROLS DIVISION • STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

RECIRCULATION MAY BE KEY TO FUTURE GROWTH OF CHEMICAL AND INDUSTRIAL PROCESSES

● AN ADAMS REPORT

Number 2 of a Series

How much water do you need to make: a ton of steel? a ton of synthetic rubber? a ton of bromine? a barrel of beer?

These are not empty questions. They point to a critical problem which confronts management today in its plans for tomorrow. It is more crtical than most of us realize . . . for industry today uses as much water as all other users.

Industry's Needs in 1975

Water is vital for chemical and industrial growth. By 1975, industry will require 215 billions of gallons daily. That is a 100% increase over our current industrial consumption . . . more than we currently consume for all uses combined.

Competing for this water will be irrigation farmers and the general public. Their combined needs by 1975 will be up 40 billion gallons a day . . . possibly even more.

What is the Supply Picture

More than 40% of the communities in the United States already have a critical water supply problem. Yet, to meet the 1975 needs, our supply must be expanded by 50%, at an estimated cost of $50 billion. ●

Indications are that industry is going to have to bear its part of this cost. Certain communities are already moving to place flat water rates on all users . . . regardless of the volume used. Other groups are demanding a national water policy with full Federal Government regulation of natural sources.

Chemical Industry's Stake

Shortage of water can be a most serious threat to the expansion hopes of the chemical industry. A glance at the following table shows why. You need approximately:

20,800	tons of water per ton of	Bromine
2,500	" " " " " "	Synthetic rubber
830	" " " " " "	Viscose rayon
300	" " " " " "	Newsprint
208	" " " " " "	Smokeless powder
15	" " " " " "	Coke from coal

While process refinements may be able to reduce slightly the amount of water needed for each product, the gains will be minor.

Difference Between Use and Consumption

This is best illustrated by the water needed to make a ton of steel. The industrial average is 65,000 gallons (271 tons). In the past, 65,000 gallons of water flowed out of a river through the steel mill and back into the river again for each ton of steel made. In this case, use and consumption are one and the same thing.

On the west coast, a large steel mill now requires only 1,100 gallons of makeup for each ton of steel produced. This steel mill has its own recirculation system which holds several million gallons of water. This water is recirculated at a rate equal to 65,000 gallons per ton of steel produced. The only water consumed is that lost due to evaporation or through leakage. Thus, net consumption has been reduced to 1,100 gallons.

Two Bulletins Available

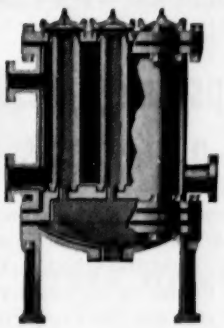
One of the most important pieces of equipment in a recirculation system is a filter. Where high quality process water is needed, diatomite filters will provide an effluent second only to distilled water. Bulletin 651, released by the R. P. Adams Company, Inc., 507 E. Park Drive, Buffalo 17, N. Y., covers this type of industrial water filter.

A second publication, Bulletin 909, covers an Automatic Water Filter which is frequently used in recirculation systems where the water is used for less critical applications. This bulletin is also available on request from the R. P. Adams Company at the above address.

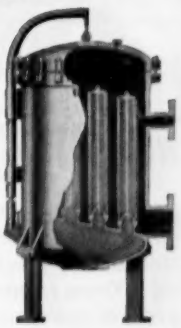
By the way, it takes almost two tons of water to brew a barrel of beer.

NEED A FILTER? FOR CORROSIVE LIQUIDS ●

Adams CFR are rubber lined filters which meet corrosion problems which require this type construction. Where lead lining is a must, the Adams CFL filter will meet your needs. Each tubular element of either filter may be removed individually for inspection, or replacement.



Adams CVF Filters are available in carbon steel, stainless steel, Monel and Nickel construction. Also constructed with submerged head for personnel safety and with outer jacket for use with steam or refrigerated coolant to maintain desired temperature.



▶ **All Adams Filters provide safe cleaning without disassembly by a sudden, high velocity reverse flow of backwash liquid.**

Do you have a filtration problem where corrosive liquids must be given a high polish? Where there is danger to personnel? Where there is a problem of temperature control?

The R. P. Adams Company has a line of filters which will solve any one of these problems . . . or a combination of all.

We may not have the answer to *your specific* problem, but the chances are we do. For the fastest action, we suggest you use the coupon below, or write for Bulletin 431 on your company letterhead.

R. P. ADAMS COMPANY, INC. 207 E. PARK DRIVE BUFFALO 17, NEW YORK

R. P. ADAMS COMPANY, INC. 0-57

207 E. PARK DRIVE — BUFFALO, 17, NEW YORK

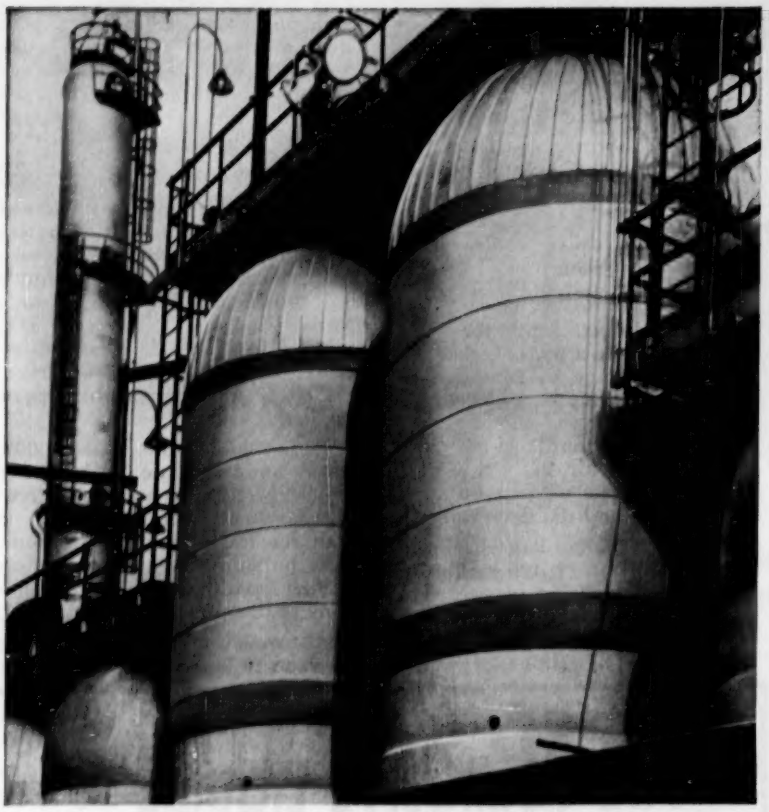
We have a problem involving the filtration of corrosive liquids. Please send us your Bulletin 431. Also, ask your local representative to call on us.

Name_____ Title_____

Company_____

Street_____

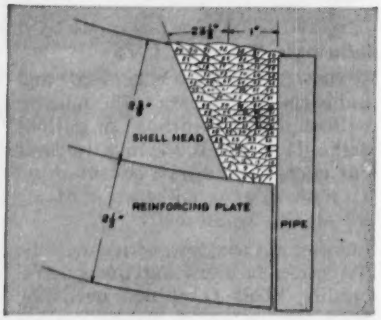
City_____ State_____



All-welded reformer reactors, built by the Eddystone Division of B-L-H in the catalytic reforming unit of Tidewater Oil's Delaware refinery recently constructed by C. F. Braun & Co.



A 20-in. nozzle on the hemispherical head of one of the reactors is preheated prior to being welded in place.



Fusing 20-in. nozzle to a reactor head required 92 passes.

Baldwin whips tough task for oil industry . . . welds 100-ton vesssel of 13 kinds of steel 3/8 in. to 5 1/16 in. thick

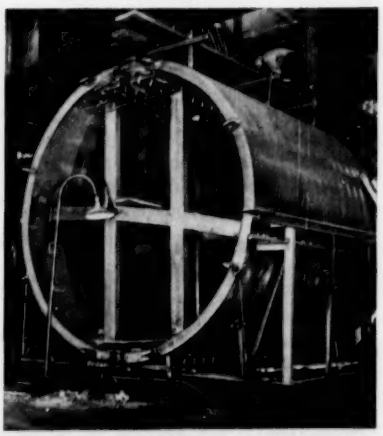
Big, unwieldy, complex, infinitely demanding – a really tough job in every sense of the word. But Baldwin-Lima-Hamilton's Eddystone Division was able to carry it out easily, economically. Ready on schedule, these two identical 100-ton reformer reactors are now producing high-octane components of aviation and motor gasolines at the Tidewater Oil Co.'s Flying A Refinery near Delaware City, Del.

Three welding methods–manual-shielded metal arc, automatic submerged metal arc, and inert gas–had to be used on these pressure vessels, which are 12 ft. in diameter and 20 ft. long. In order to minimize setup time and X-ray inspection costs, both vessels were fabricated simultaneously. As on all Baldwin work, only qualified welders were used.

The results of radiographic inspection of all welds convincingly attested to Baldwin's care and precision: no defects were found, no repair welding was necessary.

Both reactors must operate continuously for long periods of time at nearly 1000°F in a hydrogen-rich atmosphere at pressure up to 536 psi. Baldwin's highly creative fabricating skills have virtually guaranteed that they will.

For a copy of our illustrated Weldment Bulletin 7001, write to B-L-H Corporation, Philadelphia 42, Pa.



Automatic welding equipment mounted on platform above reactor cylinder is used for longitudinal seams, each requiring 64 passes.

BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings

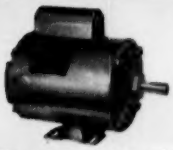
WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY

Reduce Down Time—Power your Equipment with *Dependable* Wagner Motors

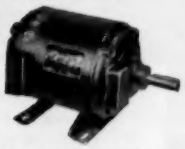
Sixty-six years of experience goes into the building of Wagner Motors. Their reputation for reliability, their electrical characteristics, price and prompt delivery make them a sound choice for your equipment.

Whatever your motor requirements may be—single-phase or polyphase... ⅛ or 500 horsepower—Wagner can offer a standard motor that is entirely dependable in its specific application. A few of the many motors in the Wagner line are shown below.

FRACTIONAL HP



TYPE RK — Capacitor-start Induction. For general purpose applications. Single-phase. Rigid or resilient mounting. 48 frame: ⅛ or ¼ hp. 56 frame: ⅓ through ¾ hp. Also available in integral ratings through 5 hp.



TYPE RA — Repulsion-start Induction. For general purpose applications. Single-phase. High starting torque—low starting current. ⅛ through ¾ hp. Also available in integral ratings through 15 hp.



TYPE RB — Split-phase Induction. For easy starting applications. Single-phase, resilient mounting. 48 frame: ⅛, ¼ or ⅓ hp.



TYPE RP — Polyphase Squirrel-cage Induction. General purpose, normal torque. 56 frame: ¼ through ¾ hp.

INTEGRAL HP



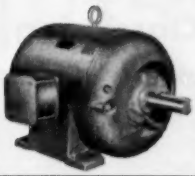
DRIP-PROOF

TYPE DP—Squirrel-cage Induction, corrosion resistant cast iron frames. 1 through 125 horsepower.



TOTALLY ENCLOSED FAN-COOLED





TYPES EP AND JP Standard and explosion-proof. Squirrel-cage Induction, corrosion resistant cast iron ribbed frames, 1 through 30 hp—smooth frames, 40 through 250 hp.



OPEN TYPE POLYPHASE SQUIRREL CAGE

TYPE RP—Drip-proof. Suitable for all general purpose applications. Available in ratings 150 through 500 hp.

OTHER WAGNER MOTORS

In addition to a complete line of standard motors, Wagner also furnishes Increment Type Motor and Starter Combinations... Wound Rotor Polyphase Motors... Jet Pump Motors... Vertical and Flange Mounted Motors... Hermetic Motors... Gear Motors and Direct-Current Motors. Consult the nearest of our 32 branch offices, or mail coupon today for full information on the complete Wagner line.



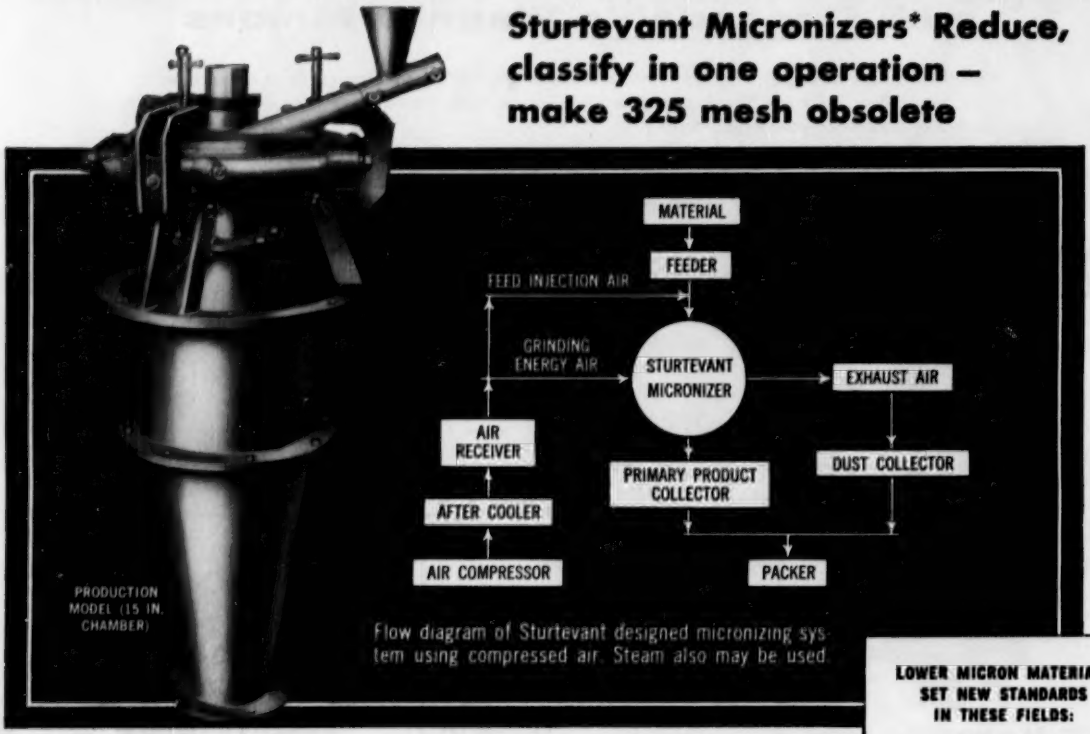
M57-10A

Wagner Electric Corporation
6407 Plymouth Ave., St. Louis 14, Mo.
Please send Bulletin MU-185 on your complete line of Motors.

NAME_____
POSITION_____
COMPANY_____
ADDRESS_____
CITY & STATE_____

Need ½ to 44 Micron Particles?

Sturtevant Micronizers* Reduce, classify in one operation — make 325 mesh obsolete



Flow diagram of Sturtevant designed micronizing system using compressed air. Steam also may be used

Particles Grind Each Other, Classifying is Simultaneous; No Attritional Heat

One operation. Sturtevant Micronizers grind and classify in a single fluid-jet chamber — provide fines in range from ½ to 44 microns to meet today's increased product fineness requirements. Because of impact action and cool atmosphere, even heat-sensitive materials can be handled.

No moving parts. Particles in high speed rotation, propelled by compressed air or steam entering shallow grinding chamber at angles to periphery grind each other by violent impact. Design provides for instant accessibility, easy cleaning.

Simultaneous classification. Centrifugal force keeps over-size materials in the grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size of fines.

Can combine other processes. Sturtevant Micronizers can be adapted for coating one material with another and for effecting chemical reactions and changes in physical characteristics, while in process of reducing solids to micron size.

Eight models available. Grinding chambers are in eight sizes, ranging from 2 in. diameter laboratory model (½ to 1 lb. per hr. capacity) to large 36 in. diameter production model (500 to 4000 lbs. per hr. capacity). Send today for fully descriptive literature.

LOWER MICRON MATERIALS SET NEW STANDARDS IN THESE FIELDS:

Pharmaceuticals
Pigments (natural and synthetic)
Copper compounds
Filler materials
Aluminum compounds
Resins
Flour
Sugar
Calcium compounds
Heat sensitive materials
Magnesium compounds
Zinc compounds
Waxes and fatty acids
Fungicides and insecticides

Fluid-Jet Systems For Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to particle size under 1 micron at a feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200 to 1400 lbs. per hr. A pharmaceutical house is using an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns at rates of 1000 lbs. per hr. Sturtevant Engineers will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. *Write today.*



CAN TEST OR CONTRACT MICRONIZING HELP YOU?

Laboratory test-micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Or, if you have limited requirements for ultra-fine grinding, Sturtevant's contract micronizing service may be the economical answer. Write for full details.

* REGISTERED TRADEMARK OF STURTEVANT MILL CO.

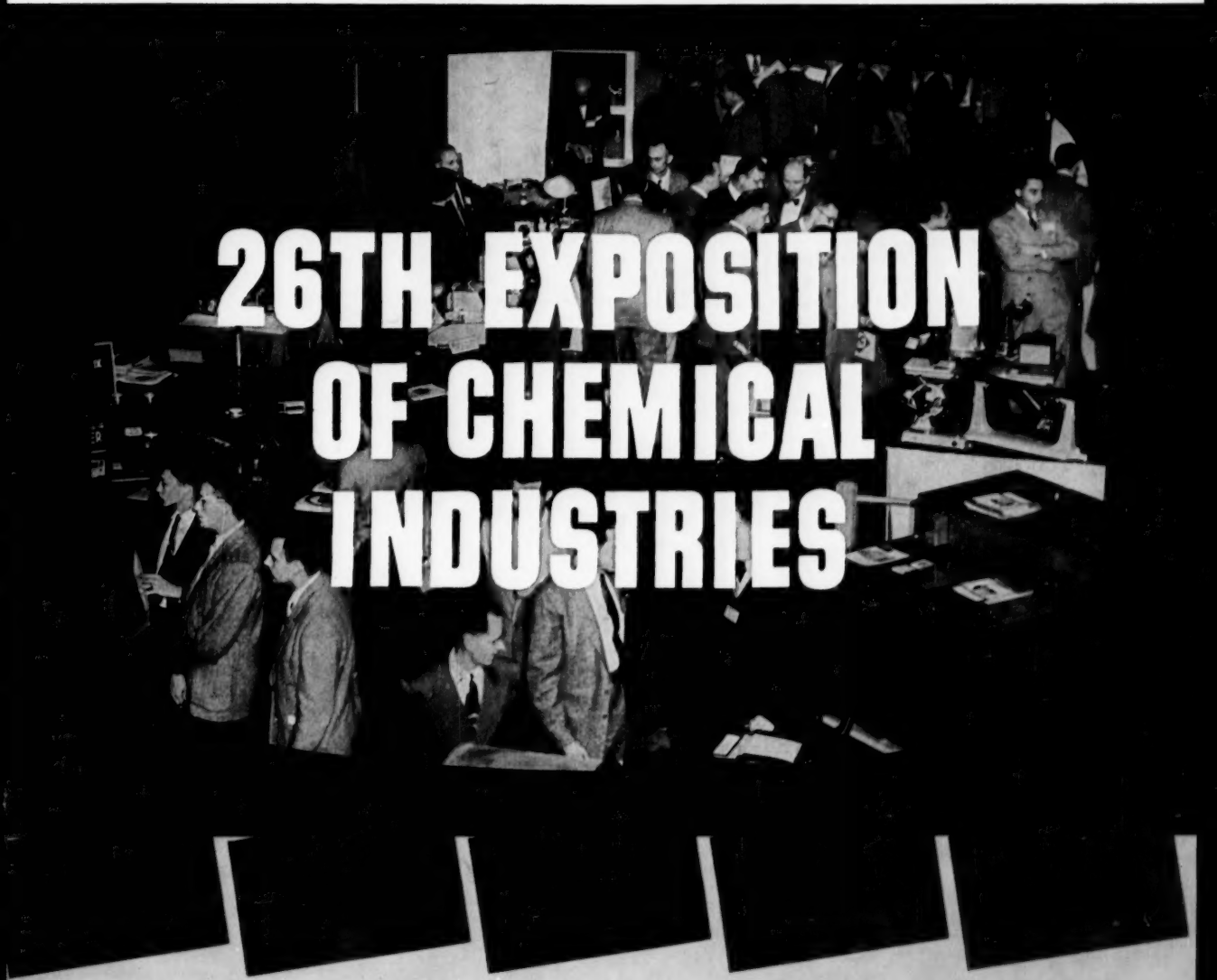
STURTEVANT

MILL COMPANY 100 Clayton St., Boston 22, Mass.

CRUSHERS • GRINDERS • SEPARATORS • BLENDERS • CONVEYORS • ELEVATORS

What's New In Chemical Progress

NEW YORK COLISEUM—DECEMBER 2-6, 1957



For the first time in six years, the greatest concentration of new and important developments in all phases of the Chemical Process Industries returns to New York City. All under one roof, you will see the results of the constant search for new processes, more efficient techniques, and improved product performance—new methods, new ideas, and new ways to cut costs, increase production.

For your convenience, new sections have been established for displays of laboratory apparatus and supplies, chemicals and raw materials. This grouping will help you secure new and helpful information faster.

Check your calendar today and make a date with your executives, engineers, designers and chemists to come and see the hundreds of new and important developments which will make your visit to the 26th Exposition of Chemical Industries the most profitable investment you ever made.

IT'S AN OPPORTUNITY FOR YOU . . . to see for yourself "what's new" in your industry. Learn about modern developments and cost-saving techniques at the 26th Exposition of Chemical Industries. Make your plans now! Fill in and mail the coupon on the other side to be sure of your advance registration. No obligation, of course.

THESE NEW PRODUCTS WILL HELP YOU CUT COSTS AND INCREASE PRODUCTION

Abrasives
Absorbers
Acids
Acidifiers
Acid Resisting Materials
Adhesives
Agitators
Air Conditioning Apparatus
Alkalies
Alloys
Analyzers
Asbestos
Autoclaves
Bags
Balances and Weights
Barrels, Drums & Kegs
Blowers
Bottling Machinery
Brick, Acid Proof
Briquetting and Tablet Making Machinery
Buckets, Elevator
Burners
Calciners
Calorimeters
Cans
Carbon
Castings
Catalysts
Cement
Centrifugals
Ceramics
Chemical Stoneware, Acid Proof
Chemicals, Industrial
Chemicals, Laboratory
Chemicals, Pharmaceutical
Chlorinators
Clarifiers
Classifiers
Coal Tar Oils
Coatings—Protective
Collectors
Colloid Mills
Colorimeters
Comparators
Compressors
Concentrators
Condensers
Containers
Control Apparatus
Controllers
Conveying Machinery and Equipment
Coolers
Cooperage
Crucibles
Crushers, Grinding Mills and Pulverizers
Crystallizing Equipment
Cylinders for High Pressure Gases
CO_2 Recorders
Decolorization and Purifying Materials
Digesters
Dissolvers
Distilling Machinery and Apparatus
Drums, Rotary, Vacuum
Drying Machinery and Equipment
Dust & Fume Collecting Systems
Dust and Spray Masks
Ejectors
Elevators
Emulsifiers
Emulsions
Evaporators
Exhausters
Extraction Plants
Extractors
Fans
Feeders
Fillers
Filling Machines
Filter Aids
Filter Cloth
Filter Paper
Filters
Fittings
Furnaces and Accessories
Gages
Gases
Glass—Optical
Glassware
Grating
Grinders
Heat Exchangers
Heaters and Heating Equipment
Homogenizers
Hoods, Fume
Indicators
Instruments, Optical
Instruments of Precision
Instruments, Testing
Insulating Material—Heating, Electric and Molded
Insulation, Furnace
Joints, Flexible
Kettles
Kilns
Labeling Machines
Laboratories, Testing
Laboratory Apparatus and Supplies
Laboratory Furniture
Lead Burning and Coating
Magnetic Separators
Masticators
Material Handling Equipment
Metal Coating and Plating
Metal Containers
Metals
Meters
Microscopes
Mills
Minerals
Mixing and Kneading Machinery
Molding Machinery
Motors, Electric
Naval Stores
Nitrators
Nozzles, Spray
Nuclear Products
Ovens
Packaging Equipment and Supplies
Packing
pH Equipment
Pipe and Fittings
Plastics
Plasticizers
Platinum—Wire, Sheet, Foil, Crucibles, Laboratory Ware
Pressure Relief and Rupture Relief Devices
Pulverizers
Pumps
Pyrometers
Recording Instruments
Rectifiers
Refractories
Refrigerating Equipment
Regulators, Pressure and Temperature
Resins and Oils
Respirators
Rotameters
Rubber Products and Equipment
Safety Equipment
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Screens—Inclined, Vibrating, Gyratory
Sealing Machines
Separators
Sieves, Laboratory
Sifters
Sinks, Laboratory, Acid Proof
Sizers
Solvent Recovery Equipment
Solvents
Spectrographs
Spectrometers
Speed Reducers
Spray Drying Systems
Steel Grating and Flooring
Sterilizers
Stills
Strainers
Switches
Tachometers
Tanks
Thermometers
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Tower Packing or Filling
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Tubes
Tubing
Turbines
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Now is the time to make your plans

to attend this bigger-than-ever exhibition of chemical progress. See first-time the latest developments in chemicals and raw materials, processing equipment, materials handling and packaging, laboratory apparatus, controls and instruments. Be sure to benefit by this fact-filled concentration of helpful information.

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Management: International Exposition Company

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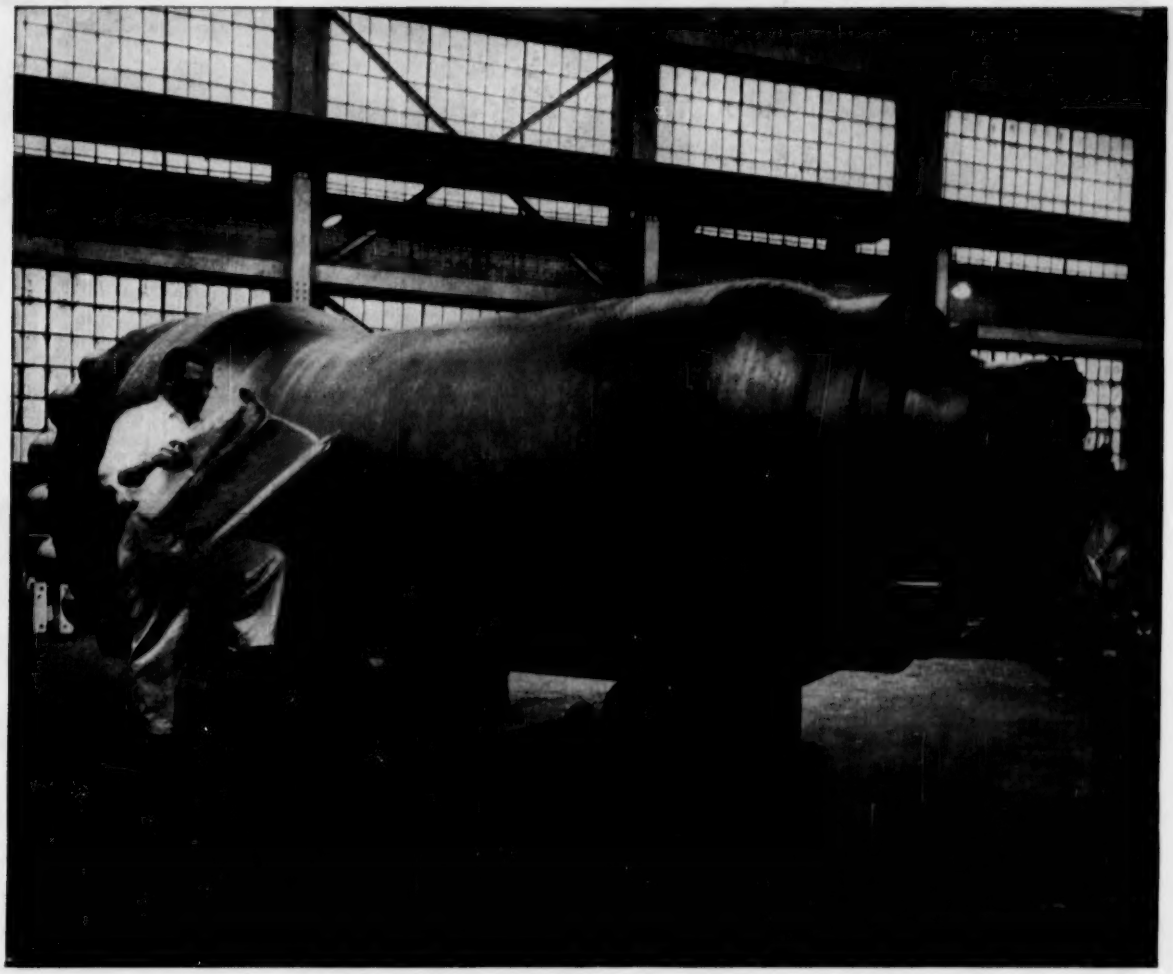
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Another Typical Bethlehem Vessel

This big forged vessel is another to come recently from the Bethlehem shops. It's a hefty brute; is approximately 14 ft long and weighs in the neighborhood of 45 tons. Its inside diameter is 48 in. Everything about it is designed to withstand high pressures.

The unit is typical of many that Bethlehem produces each year. Though not all Bethlehem vessels are of this same weight and size, they all have thick, rugged walls, massive heads, and heavy studs and nuts. Even the most minor components are designed and made for long, heavy-duty service.

Bethlehem is fully qualified to build forged vessels for the chemical, rubber, petroleum, fertilizer, food-processing, and allied industries. All sizes can be furnished, including giants weighing 150 tons and more. If you are planning new autoclaves, converters, separators, filters, reactors, or accumulators, we suggest you discuss matters with our engineers. They will cooperate fully with your staff, and will gladly help plan the types and sizes of vessels that meet your requirements.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

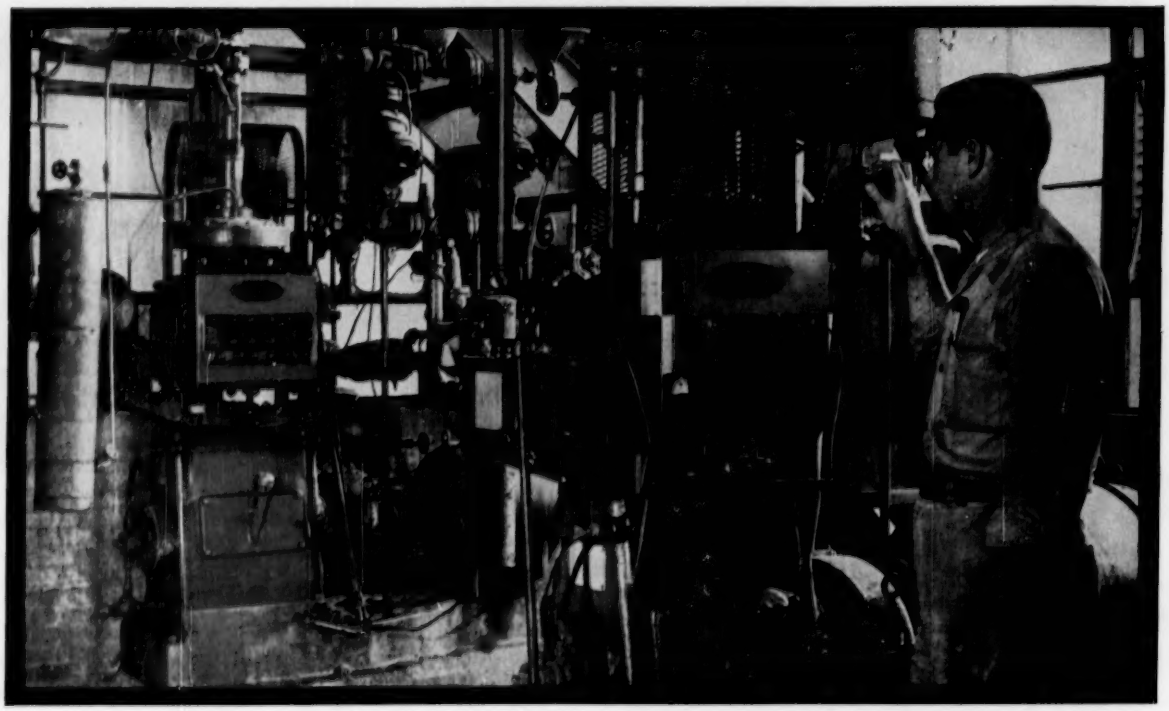
BETHLEHEM STEEL

BETHLEHEM STEEL

EMERY INDUSTRIES LICKS TOUGH PROBLEM:

How to pump fatty acids 24 hours a day, 7 days a week, and cut maintenance costs!

Around-the-clock hydrolysis produces fatty acids from animal fats, tallow, palm, soybean, cottonseed and corn oils at Emery Industries plant in Cincinnati, Ohio. Pumps work on hot corrosive fatty materials 24 hours a day, seven days a week, and maintenance used to be a costly problem. Packings had to be replaced far too often. Valves needed frequent refacing. Wear of plungers was excessive.

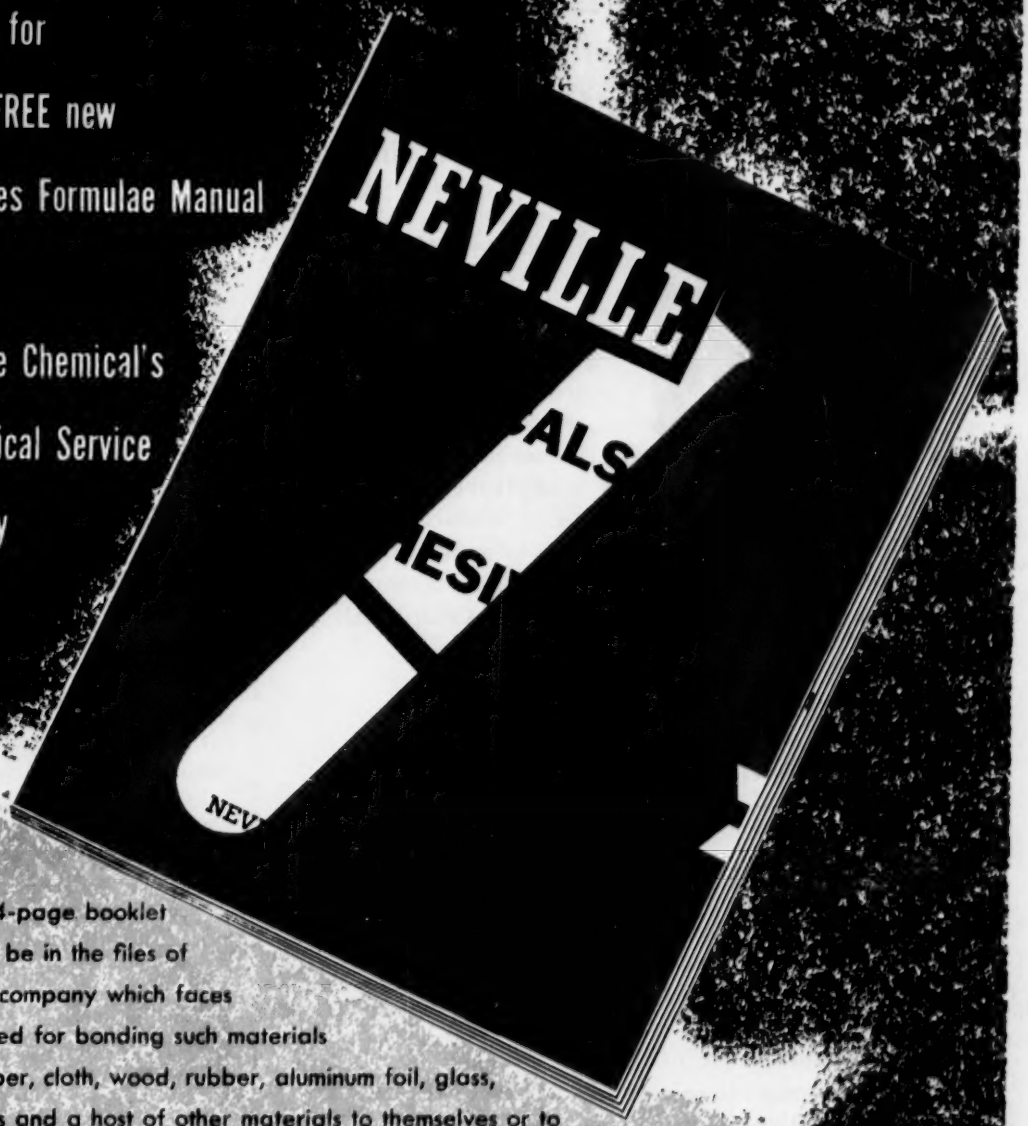


How Emery solved the puzzle: Looking for an answer to the problem of excessive downtime and maintenance, Emery conferred with several pump manufacturers. Aldrich was the only company to offer a pump better in both design and materials . . . the fluid end being of stainless steel. Original, ineffective pumps were immediately replaced with Aldrich Triplex Pumps.

Result: Two Aldrich Pumps have pumped raw materials on a continuous basis since 1948. Two more were installed for additional capacity in 1954. Maintenance costs have been reduced substantially. Downtime has decreased to a minimum. Operating efficiency is now at an all-time high and quality of processing has improved. We'll be glad to send you full information on Aldrich Pumps and their advantages to you. Simply write Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

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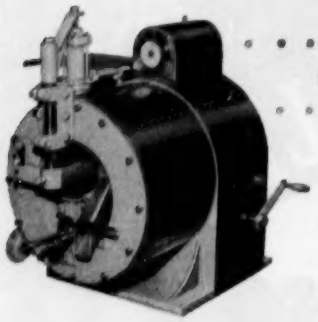
NAME TITLE

COMPANY

ADDRESS

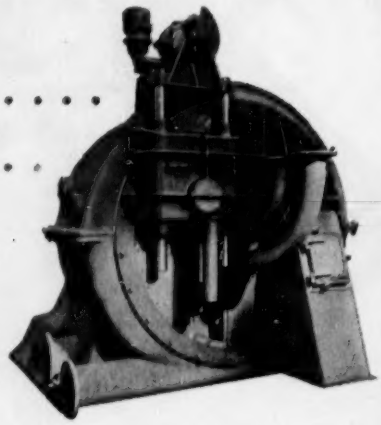
CITY NC 33-CE STATE

From TEST RUNS in your Plant... under Your OWN Operating Conditions... To Satisfactory Operation on the Production Line...



16" Centrifugal Test Machine

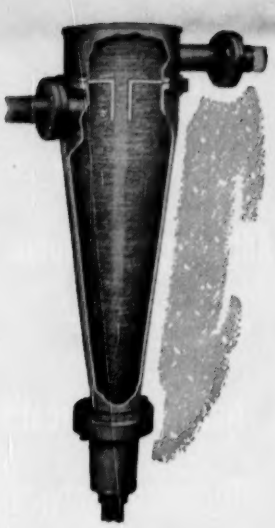
When Solids-liquid processing is your problem, we can install our 16" Reineveld for testing in your plant (with solid or perforated bowl). After a day or so of instructions, your own personnel takes over to put this pilot plant Centrifugal through its paces. Complete solids-dewatering and washing can be accomplished by this 16" Centrifugal.



79" Reineveld Centrifuge

When you have completed the tests and have established the operating cycle of the Centrifugal process, our sales engineer will then prove to you the economical values to be gained by the installation of a scaled-up production model such as the 79" Reineveld Centrifugal illustrated here.

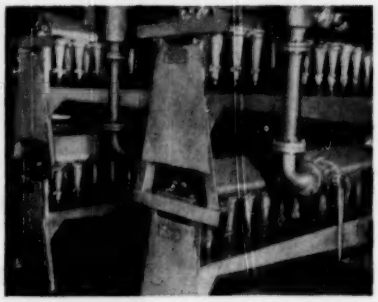
Write us for further information and request brochure RC-356, or better yet, call for a visit of our Sales Engineer.



When classifying or thickening is desired, the Heyl & Patterson Cyclone is the most economical tool for a plant where continuous flow is preferable.

H & P CYCLONES are standard in stainless steel or with rubber-lined aluminum or carbon steel bodies. They are capable of handling as little as 8 GPM, with no upper limits.

Circuits employing staged Cyclones are often used.



Heyl & Patterson
INC.

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Heyl & Patterson's Cyclone Brochure C-954 available upon request.

NEW RELIANCE P-BASE MOTORS

Designed for outdoor and indoor installations

THESE RELIANCE FEATURES offer you the best motor for your pump installations.

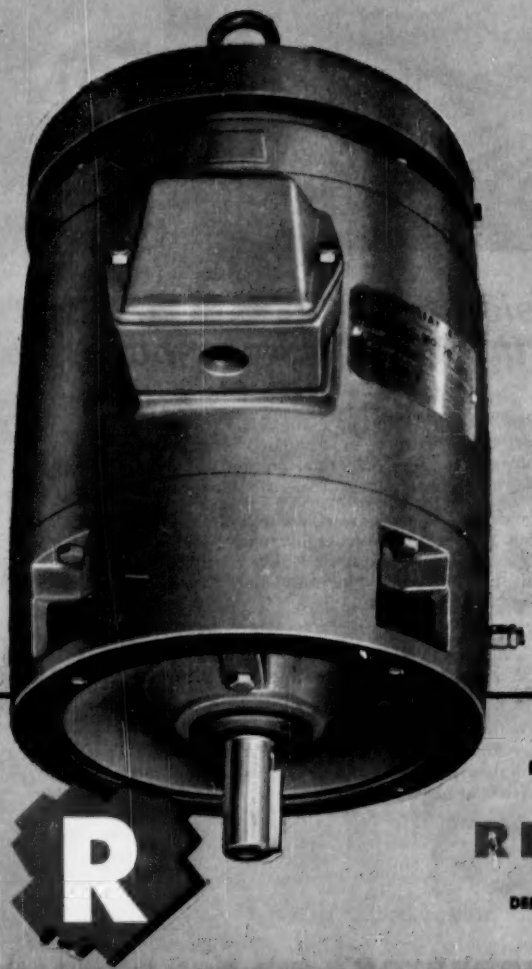
Totally-Protected, weather tight construction—Corrosion-proof cast iron housing and sealed conduit box with threaded inlet locks out water, dust and foreign matter.

Perfect pump seating—True fit machined motor flange mates perfectly with pump flange, eliminating wear from misalignment.

Life long bearing protection—Special oversized thrust bearings designed for vertical operation are protected with Metermatic lubrication; you can't grease 'em wrong.

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Totally-Enclosed, Corrosion-Proof

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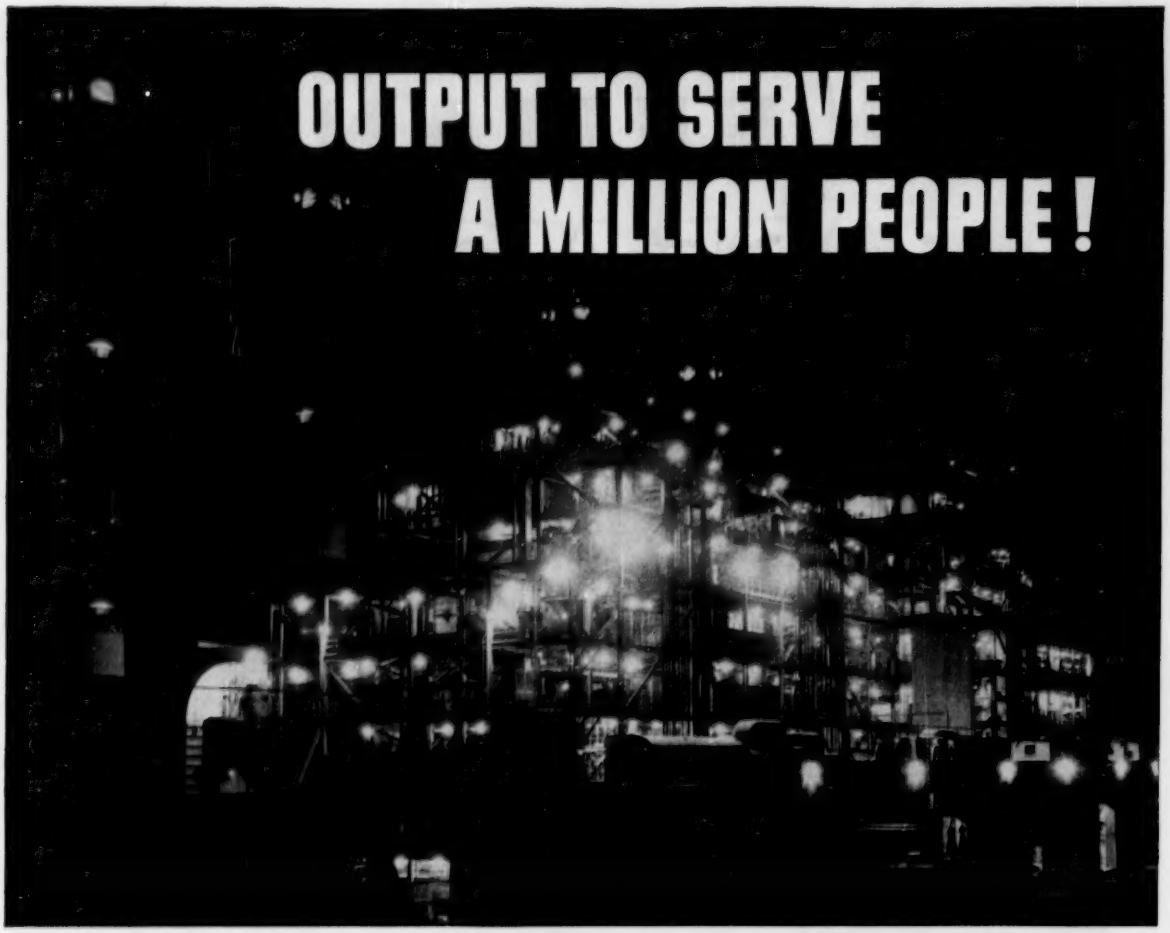
Explosion-Proof
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Write for bulletin B-2502 and check the facts on why Reliance Totally-Protected P-Base Motors are your best buy.

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Single-layer **UNIBESTOS** locks in more heat than most double-layer insulations. It resists shock, vibration, and chemical fumes—doesn't shrink to expose pipe to heat loss. Sizes to 44" o.d. Ask for UNARCO'S free 40-page booklet with exclusive "J" Factor Tables.

This is the new $80,000,000.00 Valley Steam Plant of the Los Angeles Department of Water and Power, latest addition to municipal steam electric generating facilities which, today, supply more than three-quarters of the city's electricity requirements. In 1941, 95% came from hydroelectric sources.

Valley Steam Plant is big and efficient, with a generating capacity of 512,000 kilowatts. It has about 1700 control switches, instruments, and relays; 761 miles of control wire and power cable; 605 electric motors ranging in size up to 2250 h.p. and – of course – UNIBESTOS® Pipe Insulation throughout, aluminum-jacketed where exposed to the elements.

Closed-circuit television, with six screens in each control room, keep watchful eyes on flames and water levels. Automation is a progressive reality here. And modern UNIBESTOS, on piping from 140 to 1000°F., gives further proof of the careful planning that went into this outstanding project.

UNIBESTOS also is used by the Los Angeles Department of Water and Power at the Harbor Steam Plant, by major power plants the country over . . . by petroleum and chemical processors, atomic developments, and modern industry for dependable conservation of energy.

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BAD AIR IS COSTLY...



. . . as compared to the blower that keeps air fresh

Your men can't produce at top efficiency when stagnant, hot or fume-filled air robs them of their energy.

Wherever bad air slows down production . . . in shipholds, tanks, drums, boilers or other places where men need fresh, cool air . . . a Coppus Blower becomes both a safety device and a production tool.

Portable and easily adaptable for special purposes, Coppus "Blue Ribbon" Blowers and Exhausters fit all your "fresh air" requirements. The Coppus "Blue Ribbon" means premium performance at ordinary cost. Check and mail the coupon for specific information. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, BEST'S SAFETY DIRECTORY, MINING CATALOGS.

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Six frame sizes—
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MAIL THIS COUPON! To Coppus Engineering Corp., 230 Park Avenue, Worcester 2, Mass.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ In tanks, tank cars, drums, etc.
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NAME.....

COMPANY.....

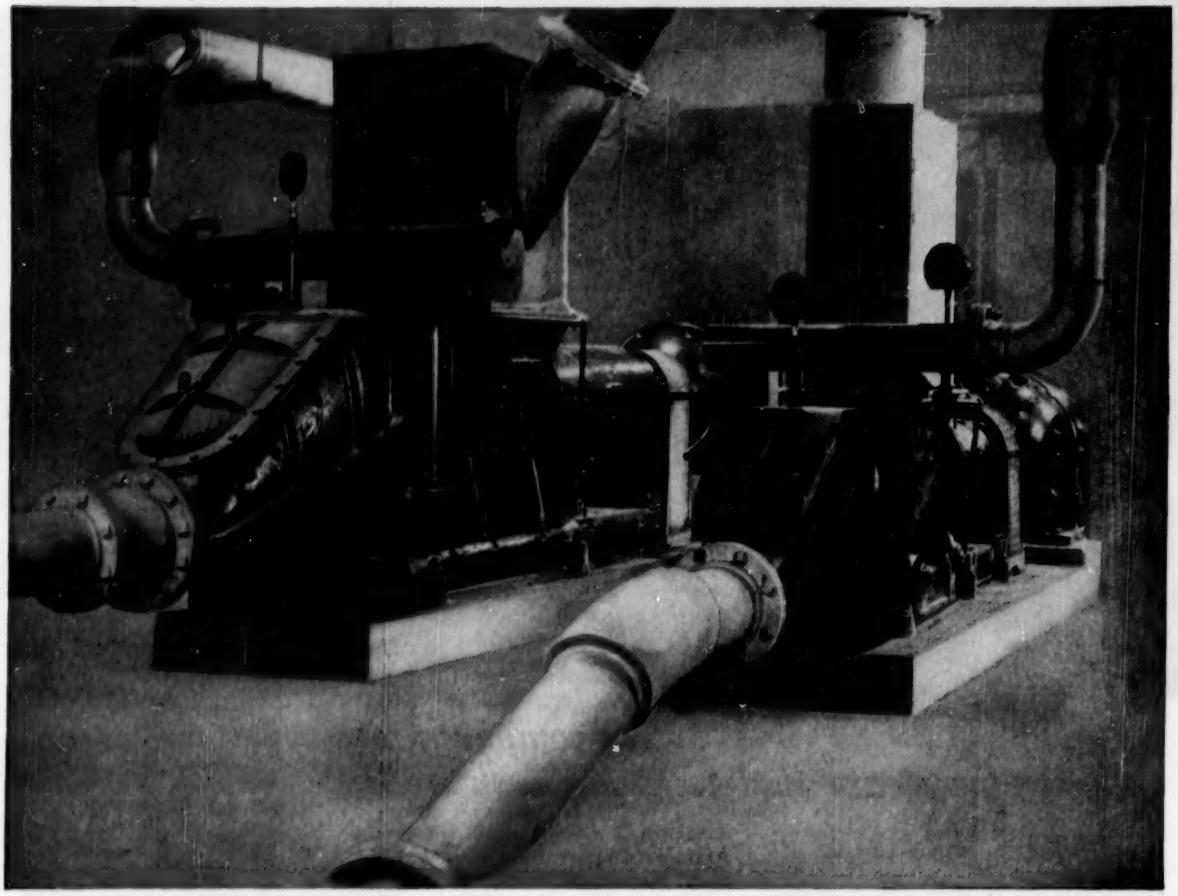
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CITY.....

(Write here any special ventilating problem you may have.)

STOP MAKING A PROBLEM

. . . out of your bulk materials handling



Sure, your dry bulk materials handling system might break down now and then. Yes, maintenance costs do seem to be on the rise. But the materials must be moved even though the handling operation itself adds not a penny to the profit side of the ledger.

Obviously, the solution to all this is to move your materials as efficiently and economically as possible—with a Fuller-Kinyon Conveying System designed specifically for your operations.

Air does the work, conveying to storage, and from storage to packer bins, process, cars, ships and barges, with maximum efficiency, cleanliness and safety. A Fuller-Kinyon System also will unload from cars, trucks, ships or barges. A one-man operation, with low maintenance, it can be remote or automatically controlled, and used anywhere a pipeline can be run.

Higher, sustained production is possible—and at reduced cost. Write now for the proved-in-service facts about Fuller-Kinyon. A Fuller engineering study of your operations, with recommendations, can be yours without cost or obligation.

P-164
3020

FULLER COMPANY
134 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
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. . . . pioneers in harnessing AIR

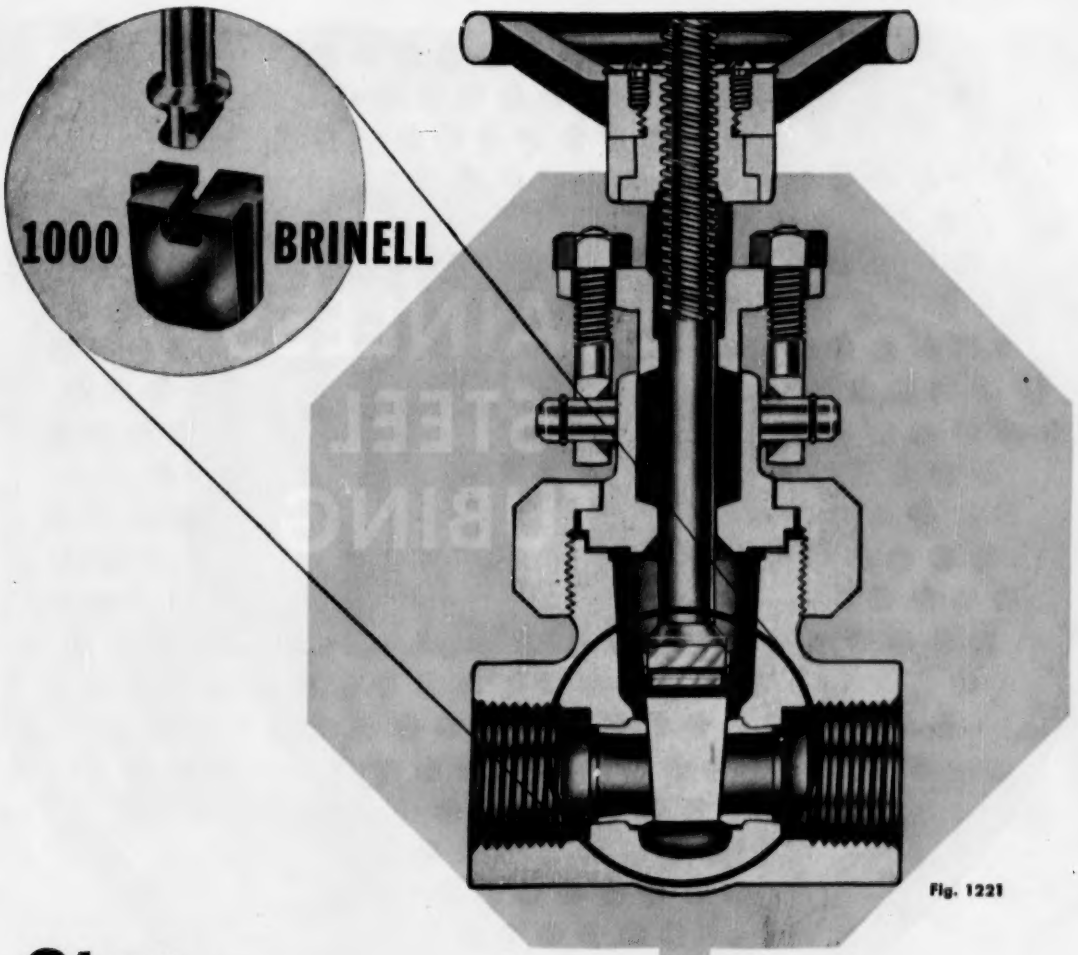


Fig. 1221

Stop Galling with the hardest valve wedges you can buy

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

Highly resistant to erosion and corrosion

Here's a wedge as hard as flint . . . so hard that it's undamaged by pipe cuttings, scale or grit. It's the only trim we know of which will successfully withstand the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling. This wedge is *13% chrome stainless steel hardened up to 1000 Brinell.*

Specify the OIC 1221 gate or 1621 globe where you need the extra rugged nature of forged steel. They are recommended for steam service up to 800°F...oil service up to 1000°F. Or, use these same valves for hydraulic service up to 2000 lbs.

Write for Form 195 for specifications on the OIC forged steel line.

THE OHIO INJECTOR COMPANY
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SPECIAL SERVICE ON REPLACEMENT ORDERS

When down-time runs into dollars with every minute, *special service* on replacement orders means substantial savings to Damascus customers.

This special service is possible because, as a supplier of tubing for original equipment, Damascus can frequently fill orders immediately from mill inventories. Where pipe or tubing required is not on hand, a large inventory of stainless strip usually permits Damascus to complete your order within days. Damascus doesn't have to wait for delivery from the strip mill.

When you need tubing in a hurry, call Damascus. We can quote delivery and prices over the phone.



Write for free booklet.

DAMASCUS TUBE COMPANY

STAINLESS STEEL TUBING AND PIPE

GREENVILLE, PENNSYLVANIA

BLOCKSON



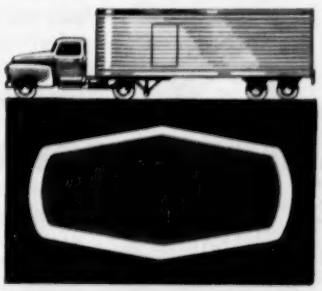
"Another ONE STOP shipment of phosphates from BLOCKSON"

You can buy all BLOCKSON chemicals in mixed carloads. ONE ORDER does it. ONE STOP delivery. ONE PHONE CALL for any schedule changes . . . carload prices on each chemical. See the list below.

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ECONOMICAL FROM EVERY ANGLE

'AMERICAN' "Every Angle" THERMOMETERS

No longer is it necessary to fuss and figure what angles of stem connection are required in thermometers for each location. These American "Every Angle" Dial Thermometers can be set at any angle within 180° on *two* axes – set at the best angle for easiest reading.

Regardless of what piping arrangements are engineered into your processes – no matter how many times they are revised – the list of American "Every Angle" Thermometers in your original specifications need not be changed. Equally important, your thermometer inventory in all required temperature ranges and stem lengths will be far smaller. That's real economy – from every angle.

Bi-metal . . . mercury . . . vapor pressure – all three types of actuation are available in American "Every Angle" Dial Thermometers. They are precision instruments that assure accuracy within 1% of scale range. Their high accuracy is sustained throughout service life, whether installed indoors or outdoors.

Make full use of these highly sensitive thermometers at all important check points in your plant. You will maintain product quality far better than ever before. Your field operators will be able to take readings more easily, more accurately, more frequently – will save time-stealing trips to the control house. Convince yourself of the all-around economy of American "Every Angle" Dial Thermometers. Write for complete information.



BI-METAL ACTUATED, TYPE 6060AH. 5" Anti-Parallax Maxivision Dial. **Temperature Ranges:** –80/120 F. to +200/1000° F. **Stem Lengths:** 4" to 24". Climate-proof stainless steel case.



MERCURY ACTUATED, TYPE 6042RM. 4½" Anti-Parallax Maxivision Dial. **Temperature Ranges:** –20/120° F. to 200/1000° F. **Stem Lengths:** 4" to 24". Climate-proof glass and stainless steel case.



VAPOR PRESSURE ACTUATED, TYPE 6040TW. 3½" Dial. **Temperature Ranges:**–20/120° F. to 260/450° F. **Stem Lengths:** 3" to 24". Models for indoor or outdoor service.

Separable sockets can be supplied in all materials and sizes normally required.

SET-ABILITY THAT MEANS FLEXIBILITY IN APPLICATION



SET IT for use as a side angle, 90°, oblique or top connection thermometer.



SET IT for use as a straight-form thermometer.



SET IT for use as an oblique-form thermometer.



SET IT for use as a standard 90° back-connected thermometer.

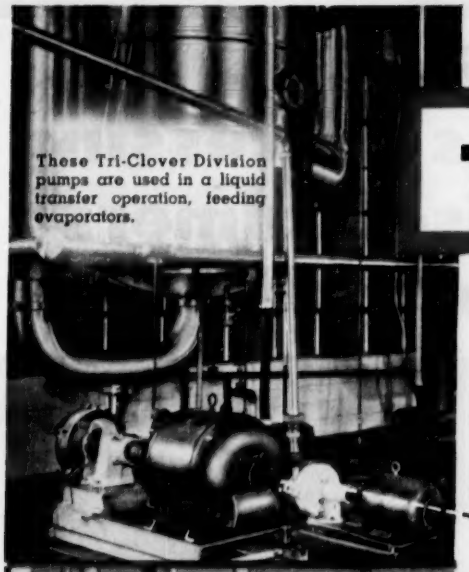
CALL ON YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for experienced counsel in dial thermometer selection. You can depend on him for prompt delivery from local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

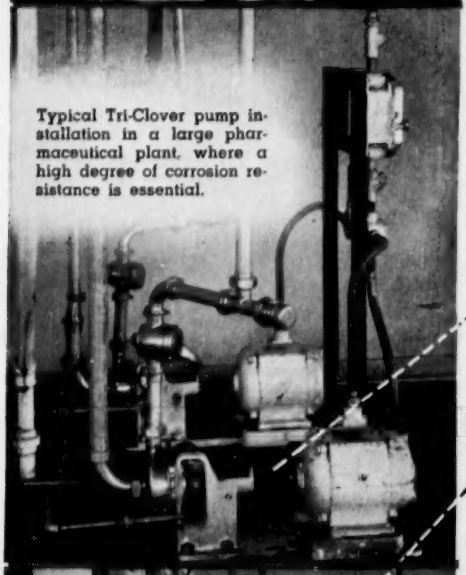
AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

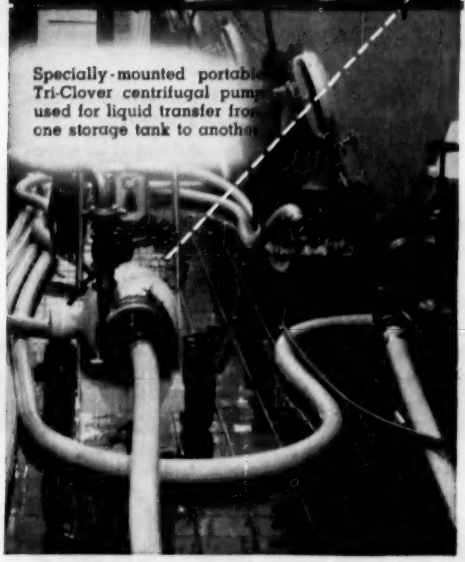
MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn., and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*



These Tri-Clover Division pumps are used in a liquid transfer operation, feeding evaporators.



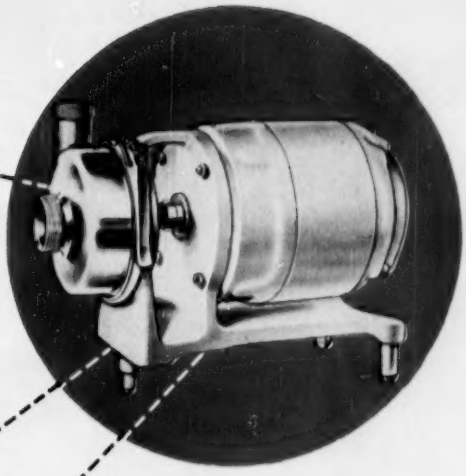
Typical Tri-Clover pump installation in a large pharmaceutical plant, where a high degree of corrosion resistance is essential.



Specially-mounted portable Tri-Clover centrifugal pump used for liquid transfer from one storage tank to another.

TRI-CLOVER

CENTRIFUGAL PUMPS



..an efficient solution to corrosion-resistant pumping problems

Available in stainless steel, nickel alloy, bronze and cast iron, Tri-Clover Division pumps are designed for efficient liquid transmission with high resistance to corrosion. These modern pumps offer many exclusive features, including patented screw type impellers with quick-acting impeller clips, lightweight heads with a minimum of parts, casing construction permitting fast, easy assembly or disassembly—and a wide choice of seals for various applications.

Tri-Clover's exclusive developments are the result of many years of specialized engineering experience and thorough knowledge of liquid handling. Let our engineering staff work with you in solving your pumping problems.

See your nearest Tri-Clover distributor, or write:

TRI-CLOVER

LADISH CO.

Tri-Clover Division

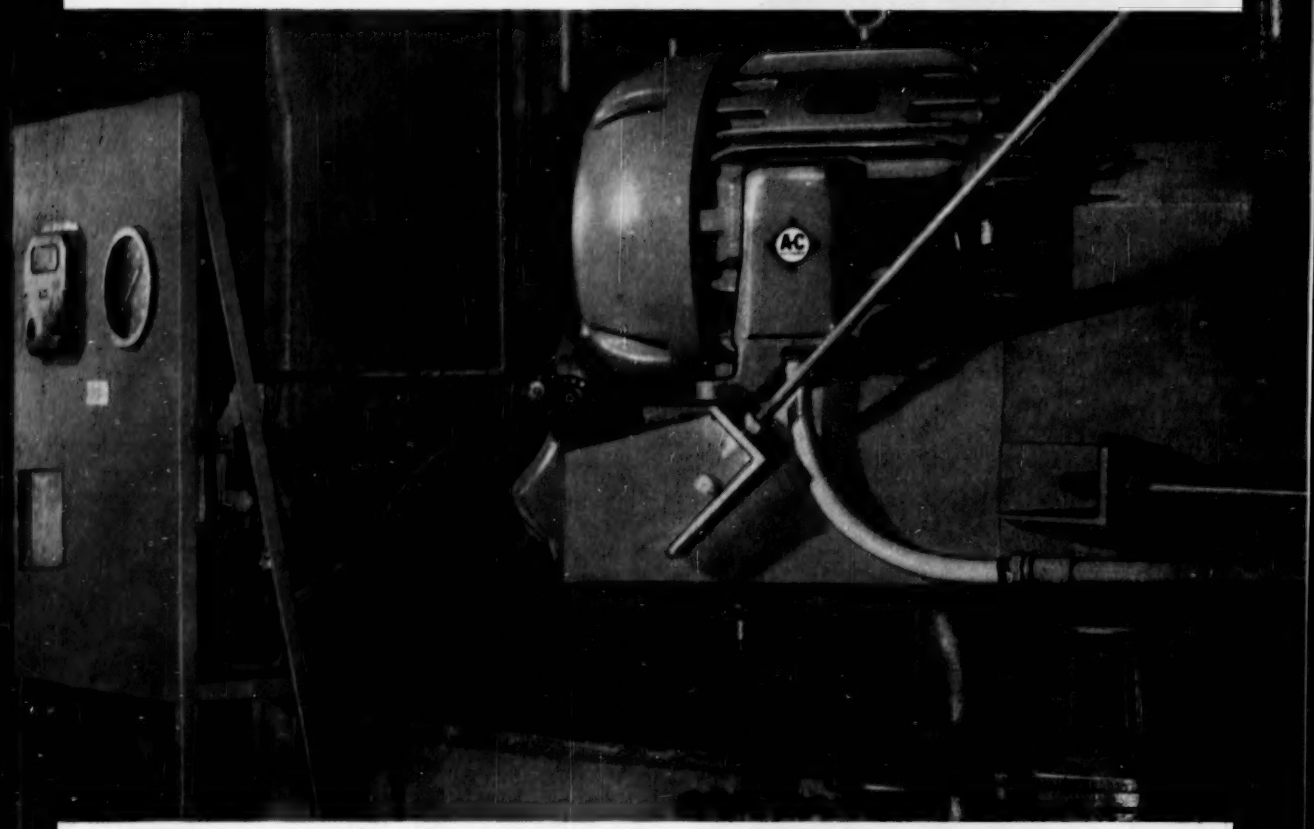
Kenosha Wisconsin

EXPORT DEPT., 8 S. Michigan Ave., Chicago 3, USA Cable: *TRICLO*

In Canada: 37 Hanna Ave., Toronto 3, Ontario

For the chemical industry...

There's MORE continuous processing with Allis-Chalmers chemical MOTORS



Maximum protection against moisture, acid, alkali and heat is built into the Allis-Chalmers line of chemical motors. This results in fewer motor stoppages, uninterrupted processing, and more profitable plant operation.

Special safeguards against breakdowns are standard on Allis-Chalmers chemical motors:

1. All external stationary parts are cast iron.
2. Hex head cap screws, Parkerized for corrosion resistance, are used throughout.
3. Stator gets *five* dips-and-bakes in extra-insulating varnish . . . followed by two coatings of enamel.

Find out more about the "MORE" in Allis-Chalmers motors by contacting your nearby A-C office or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

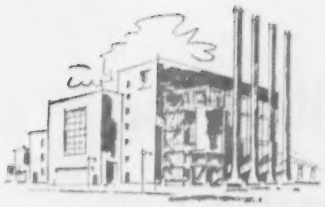
For Fast Delivery, check Allis-Chalmers first! Chemical motors are available in all enclosed designs. Shown here is a totally-enclosed model powering an agitator in a midwestern chemical plant.

ALLIS-CHALMERS

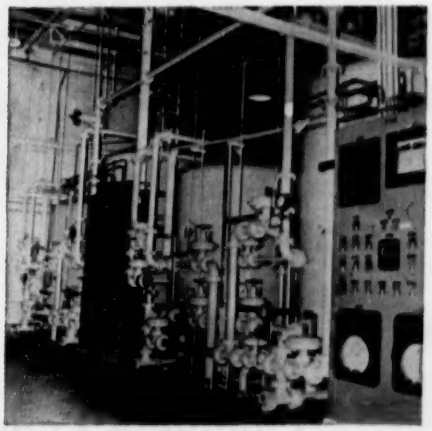
A-C ALLIS-CHALMERS

A-5179

First in water conditioning

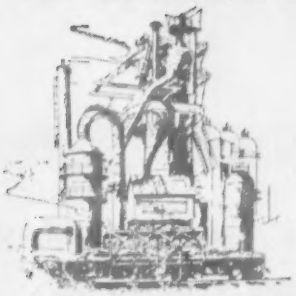


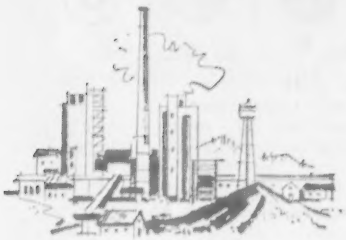
Installation below is a large paper mill. It provides an effluent with silica content below 0.02 ppm and total dissolved solids below 1.0 ppm. Total capacity 100,000 lbs/hr. for 1200 psi boiler.



Cochrane DEMINERALIZERS

for efficient silica and solids reduction





Many of America's outstanding high-pressure steam generating plants are protected by Cochrane Demineralizers. The quality of demineralized water is superlative and Cochrane's progress in solving the many problems associated with demineralization is attested to by some of the largest installations in the world.

Cochrane's untiring staff of chemists, engineers and research men assure you of the answer to your water conditioning problem and continued satisfactory operation of your Cochrane installation.

Why not investigate the impressive list of Cochrane 2-bed, 3-bed, 4-bed and mixed bed Cochrane Demineralizer installations? For the answer to your water conditioning problems consult Cochrane's complete service first. Ask for Bulletin 5800.

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3113 N. 17TH STREET, PHILADELPHIA 32, PENNA.
NEW YORK • PHILADELPHIA • CHICAGO

Cochrane Water Conditioning Ltd., Toronto 4; Montreal 1, Canada

Representatives in 30 principal cities in U.S., Paris, France, La Spezia, Italy, Mexico City, Mexico, Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii; Manila, Philippine Islands.

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Ad No. 4.04

Progress Report on New Computer Developments

Now General Electric Offers You Complete Computer Machine Time and Computer Services

AT YOUR SERVICE: AN EXPERIENCED STAFF AND THE NEWEST COMPUTER

Immediate assistance in the form of a complete range of General Electric computer services is now available to business, industry and government. Facilities include an IBM 704 Computer having high-speed, random-access core storage of 8192 words, magnetic drums, and ten magnetic tape units. The peripheral equipment provides for complete flexibility in selecting the input and output media.

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The three basic areas of General Electric's Computer Service:

1. COMPUTATION SERVICE

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G.E. provides complete data processing service, including the submission of interpretive reports to fulfill your exact requirements. Machine time is now available for either single or recurring tasks.

3. REQUIREMENTS EVALUATION

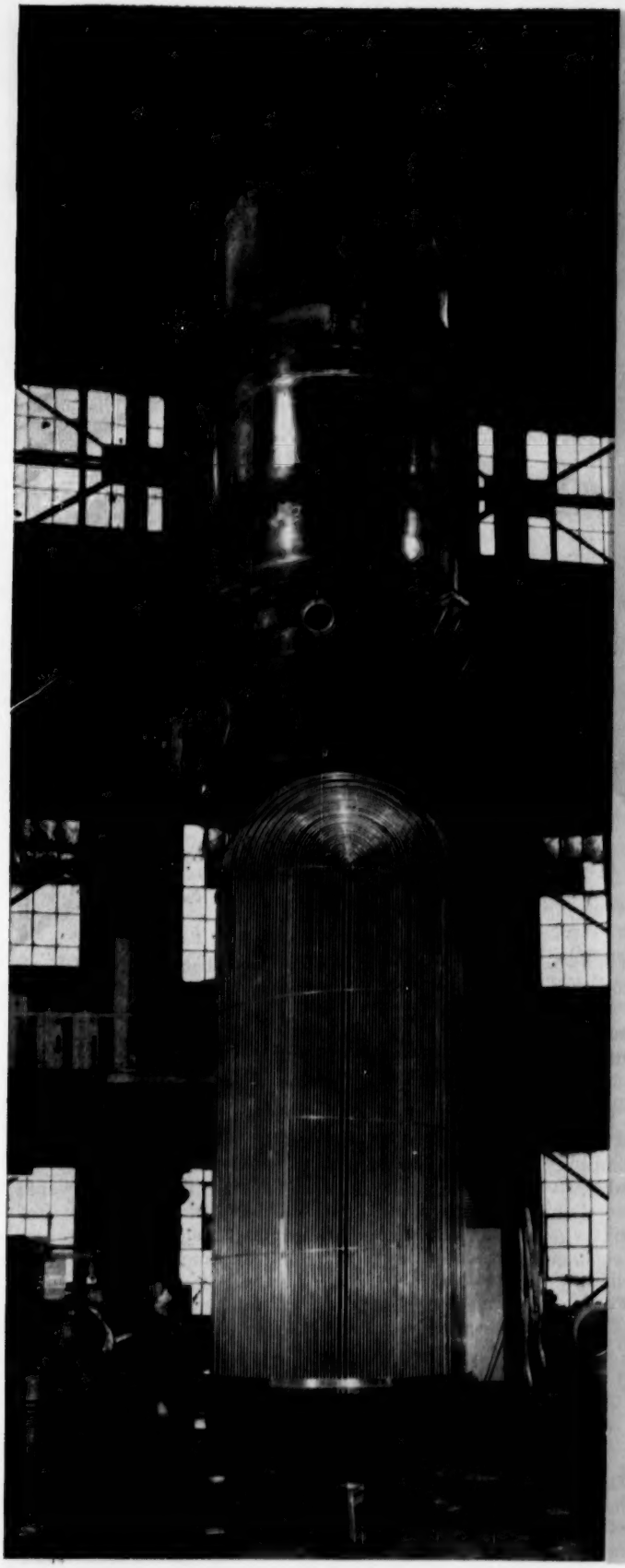
G.E. can evaluate your requirements for data processing and assist you in selecting the correct computer for the task. In addition G.E. will coordinate the installation, develop the program and train personnel to operate the computer.

For complete information contact: General Electric Company, Computer Department, Marketing Section, 1103 North Central Avenue, Phoenix, Arizona.

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CPA-2 (6-57)



YUBA

A GREAT NEW NAME IN HEAT EXCHANGERS

▶ The name YUBA now appearing on heat exchangers all over the country is new. But the plants in Pennsylvania, New York and California which make YUBA heat exchangers are old in experience. Some have been designing and manufacturing heat transfer equipment for more than half a century.

For example, the YUBA Heat Transfer Division was formerly the Heat Exchanger Division of the world-famous Lummus Company; the Calsteel Division has established its own well-recognized name in the West; and the Adsco Division includes the former Alberger Heater Company.

YUBA's experience is, therefore, YUBA's assurance to its customers that the heat exchangers they order are expertly designed for required operating pressures and temperatures and for maximum heat transfer.

Take, for instance, the mammoth exchanger shown at the left, one of four built at the Buffalo Plant. The customer asked for a corrosion-resistant exchanger with tremendous capacity for a secret process. YUBA built this giant which weighs 50 tons, has 12½ miles of tubing with 14,000 sq. ft. of heat transfer surface. The welding of the 16-ton copper silicon shell attracted industry-wide attention.

Consult YUBA when ordering heat exchangers and benefit from YUBA's vast experience and East-West facilities.

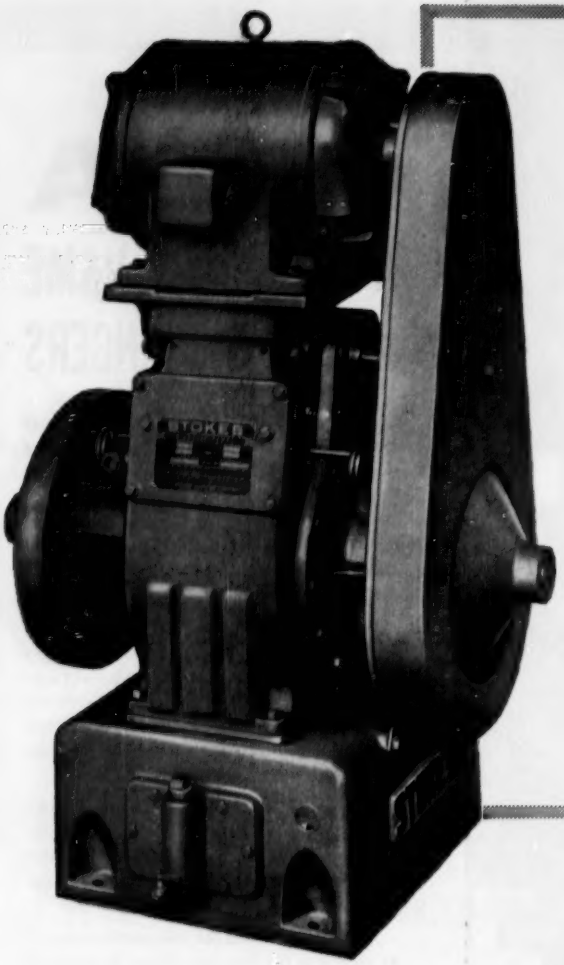
YUBA

CONSOLIDATED INDUSTRIES, INC.

New York Sales Office: 530 Fifth Avenue
Branch Offices and Representatives in Principal Cities

Divisions Manufacturing Heat Exchangers

Yuba Heat Transfer Division, Honesdale, Pa.
California Steel Products Division, Richmond, Cal.
Adsco Division, Buffalo, N. Y.



VERTICAL DESIGN

vacuum pump saves you floor space

If floor space for your vacuum system installation is a problem, here's an "assist" from Stokes. Special Stokes vertical design cuts floor space requirements. For example, the 130 cfm Model 212 Microvac measures less than 3 feet on a side . . . makes your entire set-up smaller.

And together with these features of compactness, you get a 15% increase in pumping capacity . . . at no increase in price. In this way, Stokes Microvac pumps measure up as the standard of comparison for reliable, low-cost performance.

Here's what you get with the Microvac line:

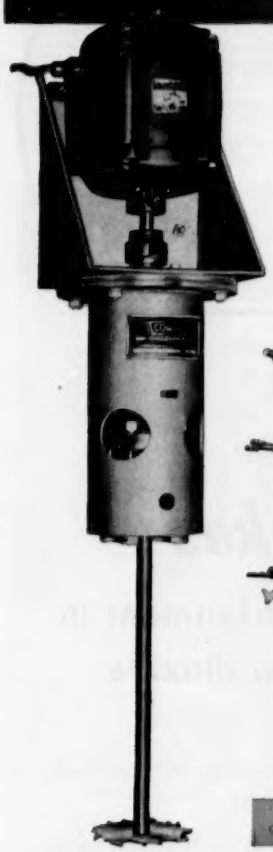
- Minimum maintenance—mechanical face seal eliminates oil leakage at shaft. No stuffing boxes. Fully automatic lubrication.
- Wide pressure ranges—new exhaust valve design assures trouble-free operation during extended pumping periods, in the high pressure range.
- Dirt troubles prevented—intake screen filter traps dirt, scale and other damaging solids.
- Added protection—new oil filter in the line supplies extra protection to bearings and shaft seal.

Microvac pumps give you the high efficiency you want . . . used separately or as roughing pumps with diffusion or booster pumps. Write for catalog 752, "Stokes Microvac Pumps for High Vacuum"; Booklet 755, "How to Care for Your Vacuum Pump" . . . or call your nearest Stokes office to find out how we can help you solve your particular vacuum application problem.

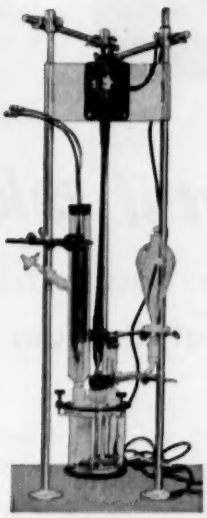
Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

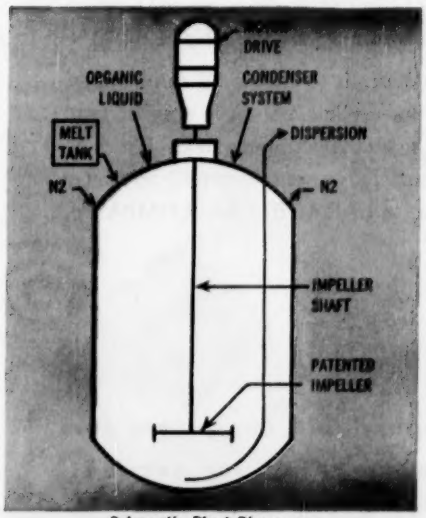
New Cowles Dissolvers Can Help You Solve Metallic Dispersion and Reaction Problems



Cowles Pilot-Plant Sodium Dispersion Dissolver



Cowles Laboratory Sodium Dispersion Dissolver



Schematic Plant Diagram

Big volume sodium and lithium dispersions finished in 30 minutes or less, particle size as small as 2 microns, with plant-proven Cowles equipment.

Highest quality metallic dispersions can now be easily controlled and produced in big volume, making many reactions commercially practical for the first time.

Key to the new method is the unique action of the patented Cowles impeller. With rim speeds of up to 6150 fpm, the impeller vanes create a zone of intense turbulence and hydraulic shear. The liquid is moved rapidly through itself until maximum dispersion is obtained. The Cowles thus gives several many very important advantages:

Versatility — prepares material for many reactions under conditions not heretofore possible.

Finer particle size — gives maximum reaction surface to dispersed elements.

More complete dispersion — assures complete homogeneity of material.

Greater speed — cuts finished dispersion time substantially.

Cleanliness — self-cleaning impeller will not clog with metal.

Safety — gives the close control necessary with highly active materials.

Predictable results — laboratory and pilot-plant models provide results easily duplicated in larger models.

New Cowles Dissolvers with properly sealed and specially designed drives for metallic dispersions are available for all purposes. Included are "package" models in both laboratory and pilot plant types, and models for commercial production. All are thoroughly proven in actual plant operations and represent the broad experience and know-how of our organization – the established leader in its field. Specialized engineering assistance can be supplied if desired.

For complete information write today for Technical Bulletin No. 21-1957, "Metallic Dispersions with the Cowles Dissolver."

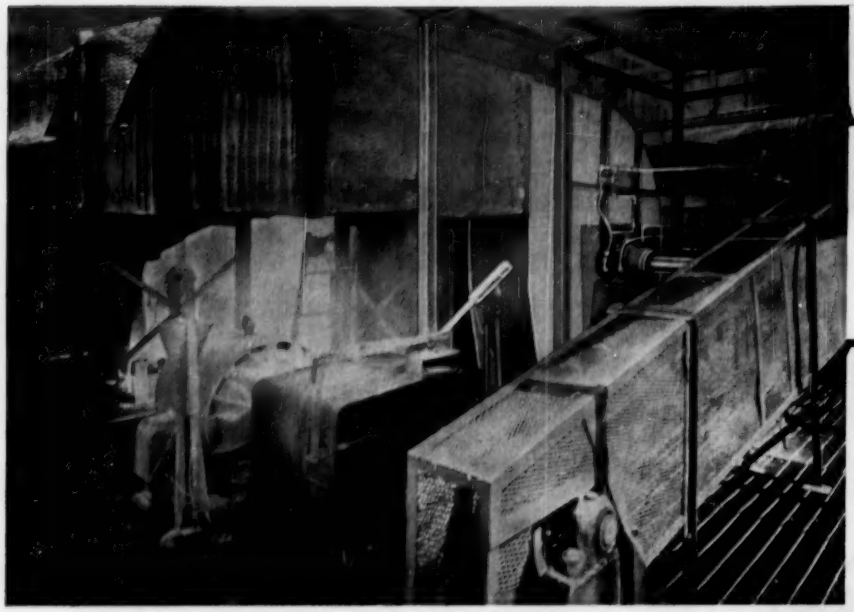
Additional Cowles Dissolver models are available for efficient processing of all solid-liquid, liquid-liquid and gas-liquid products.

Take advantage of the unusual *Morehouse-Cowles Processing Equipment Application Service* at no obligation – for a comprehensive survey of your plant requirements and end products, with laboratory assistance and in-plant tests at our risk.

MOREHOUSE® COWLES

MOREHOUSE-COWLES, INC.
1150 San Fernando Road, Los Angeles 65, California
Distributors in Principal Cities
Convenient lease and time-payment plans

5702



One of several Clarage Type XL Fans used in this application. Fan equipped with stainless steel wheel and V-belt driven from a hydraulic coupling.

Clarage Fans have what it takes

for this tough exhaust assignment in the production of titanium dioxide

Exhausting 800° F gases from rotary calciners through scrubber units and electrical precipitators to the atmosphere.

That's the demanding task this large chemical manufacturer gave Clarage Type XL Fans.

What kind of a job evaluation does Clarage receive? Several repeat orders furnish the answer. In fact, three additional Clarage Fans will soon be installed in a major expansion at this plant.

You, too, will find it pays dividends to choose the fan name of quality — Clarage. Call us in for capable assistance on your next requirements in the air handling and conditioning field. It's characteristic of Clarage equipment to prove out successfully no matter how exacting the application. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

CLARAGE ... *dependable equipment for making air your servant*

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

This pneumatic flow control gives

LIVE-ACTION RESPONSE . . . 1000 feet from panel!



Complete elimination of controller-to-valve response delay! True close-coupled control even when the operating panel is *hundreds* of feet away. These are big features you'll find in the Foxboro Model 59 flow control system.

The M/59 is the only controller specifically designed for direct mounting on the control valve motor. Need for brackets and controller-to-valve piping is eliminated. This unique force-balance controller has only two moving parts. There's no explosion hazard with this all-pneumatic system. And there are no bearings; no linkages – nothing to align or go wrong.

Learn how the fast response and simple adjustment of the low cost M/59 Controller, teamed up with the Foxboro d/p Cell Transmitter, will improve control of your process flows. Write today for Bulletin 470.

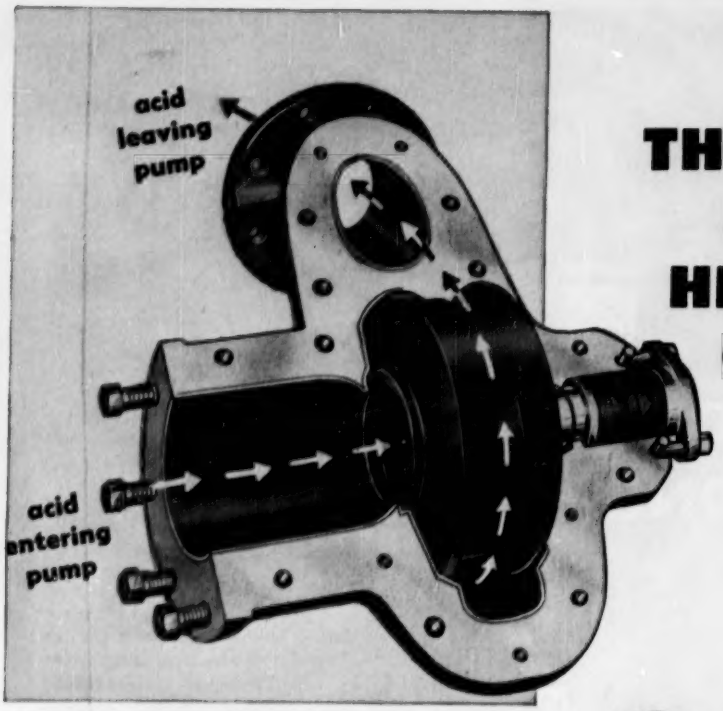
The Foxboro Company,
3610 Neponset Ave.,
Foxboro, Mass., U.S.A.

MODEL 59
VALVE-MOUNTED
FLOW CONTROLLER

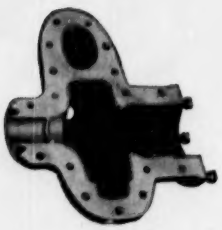


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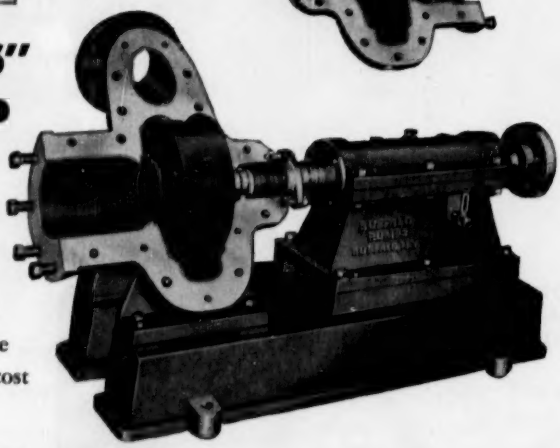
FLUID FLOW SYSTEMS



THE PUMP THAT BEATS THE HIGH COST OF CORROSION!



"BUFFALO" TYPE "DS" RUBBER-LINED PUMP



If you pump corrosives or solutions containing abrasive solids, you'll save money with this "Buffalo" Pump. Rubber permanently bonded to the impeller and all liquid passages prevents the corrosion that could quickly put an ordinary metal pump out of action. Your savings in downtime and pump replacements quickly pay for the extra cost of the rubber lining.

And this "DS" pump design saves you in other ways, too. The efficient shrouded impeller does not depend on close running tolerances. It's non-clogging, which is why the "DS" is widely used in paper mill service, as well as in the chemical industries. It's just one of the broad line of "Buffalo" Centrifugal Pumps to move *your* liquids at the lowest possible cost over the longest possible period. Write for Bulletin 982 — *your* pump is in it!

SIMPLIFIED SERVICING

Is readily apparent in this photo. Upper half of the diagonally split-shell pump casing is quickly removed without disturbing discharge piping — exposing impeller, stuffing box and passages for easy inspection and servicing. Upper main bearing half, too, is readily removable. Note rugged pump and bearing stands, ample stuffing box and bearing oil reservoir, all contributing to durability and reliability on the job.

"Buffalo" PUMPS

BUFFALO PUMPS

Division of Buffalo Forge Co.

501 Broadway • Buffalo, N. Y.

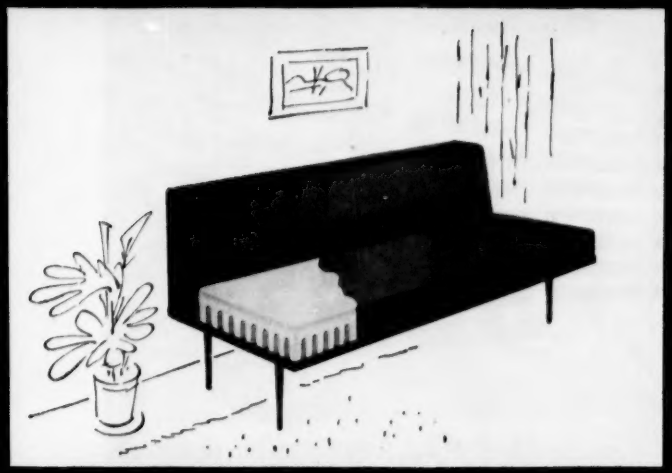
Canada Pumps, Ltd., Kitchener, Ont.

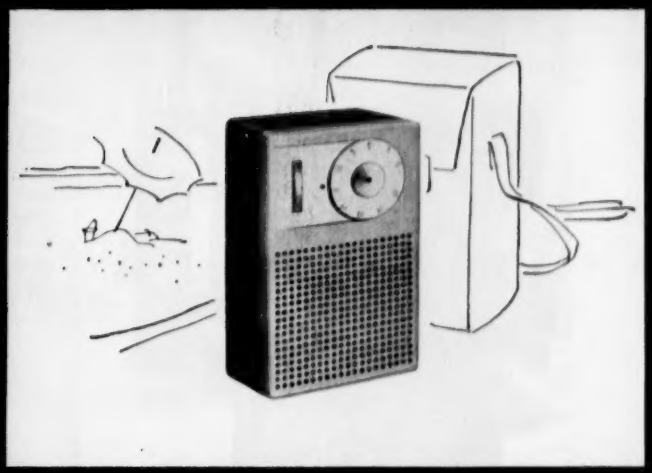
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

PRODUCT QUALITY

Mallinckrodt®





Synthetic Rubber

Potassium sulfate supplied by Mallinckrodt plays a significant part as an electrolyte to control the degree of polymerization in the manufacture of synthetic latex rubber. While this is an important application, it is not the only one. Important too, is the use of *potassium sulfate* in the manufacture of dry cell batteries . . . gypsum wall board . . . and many other products.

Electronic Devices

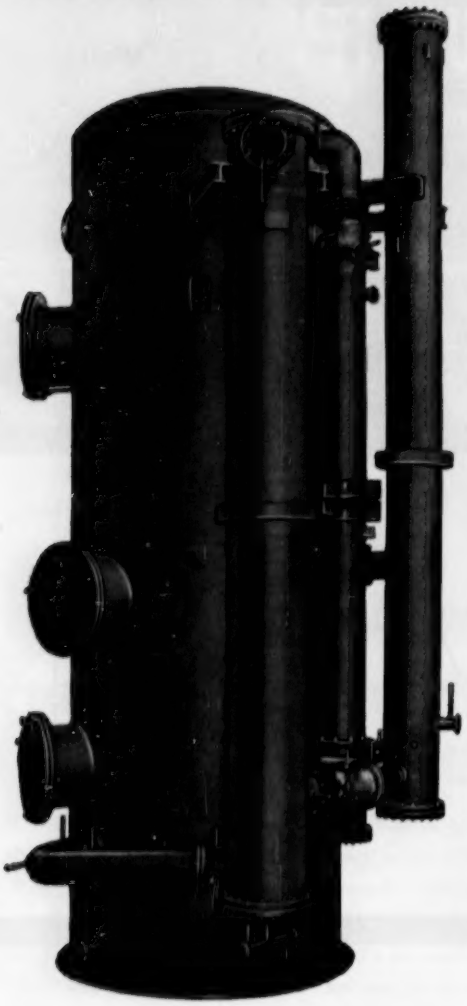
In batteries *mercuric chloride* is used as a depolarizer, *mercurous chloride* is an electrolyte, and *mercuric oxide* is used as a depolarizer in certain special-use cells. Apart from the electronics field, *mercurous chloride* has such varied functions as a catalyst in the manufacture of vinyl chloride and as a fungicide in the treatment of seed potatoes. *Mercuric oxide* is used as an anti-fouling agent in marine paints.

Your particular application of these *and other Mallinckrodt industrial chemicals* may be different. Drop us a note on your requirements — *you might be better served by Mallinckrodt.*

Mallinckrodt® **MALLINCKRODT CHEMICAL WORKS**

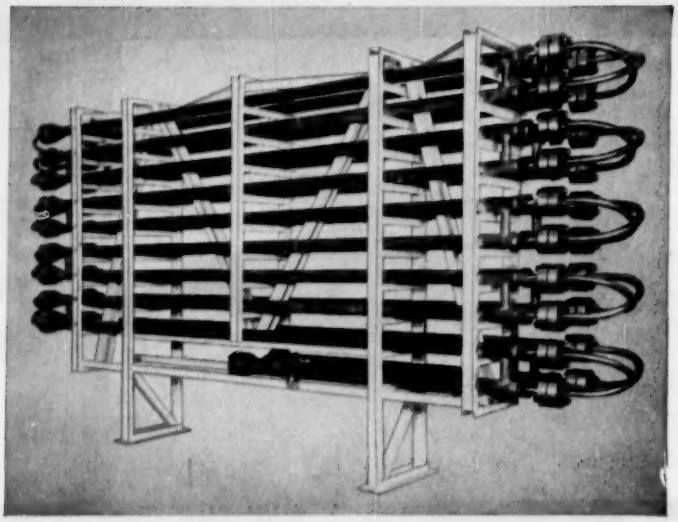
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IN CANADA: **MALLINCKRODT CHEMICAL WORKS LIMITED** • MONTREAL • TORONTO

HEAT EXCHANGERS to match your special needs



You can depend on Whitlock Heat Transfer Equipment to satisfy your most complex requirements. Whitlock designs and manufactures not only the standard sizes and types of heat exchangers, but special exchangers for high and low temperature service, for operating pressures ranging from complete vacuum to thousands of pounds per square inch, constructed of almost any workable material. These exchangers are supplied as individual units, semi-packaged systems, or packages having complete operating controls. Write for recommendations and Bulletin 250.

THE WHITLOCK MANUFACTURING CO.
94 South St., West Hartford 10, Conn.
In Canada: Darling Brothers, Ltd., Montreal



Typical of many packaged units regularly manufactured by Whitlock, this large convertor with auxiliary heat exchangers comprises a complete operating unit. Whitlock Engineers are thoroughly experienced in designing heat transfer equipment to meet your special operating conditions.

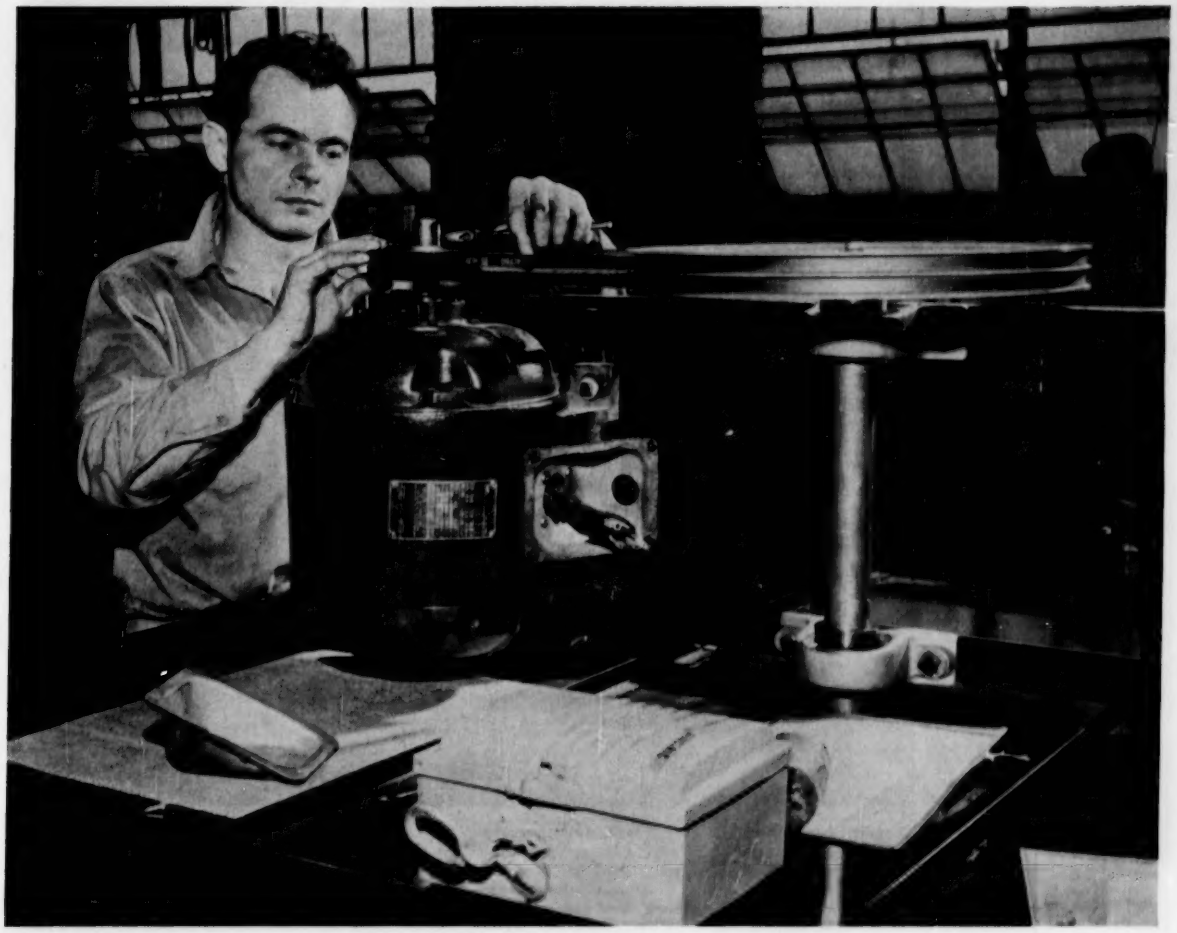
A primary aftercooler designed to remove the heat generated in compressing ethylene gas to 3700 lbs. per square inch. The inner cooler tubes containing this pressure are of heavy wall seamless steel, with their external walls protected by a cladding of admiralty metal from corrosion by the water in the outer pipes.



Secondary gas precooler is one of nine used with the reactor in a modern chromium ore plant. This stainless steel cooler reduces stack gas temperature from 1500° employing cooling water at about 100°F. Since it was necessary to provide means for accommodating the expansion of component parts due to the elevated temperatures, two corrugated expansion joints were included in designing the unit.

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.



AT PENN VENTILATOR COMPANY

DIEHL motors increase product dependability

Operating dependability is an inherent feature of the power-roof ventilators made by Penn Ventilator Company, Philadelphia, Pa. Usually, these ventilating units are installed in locations completely exposed to the elements and relatively inaccessible for regular servicing. Failure in operation, however, could halt an important manufacturing operation or even cause complete plant shut-down. Hence, every detail in the design and construction of Penn Ventilators is considered with a view to the assurance of uninterrupted operation for long periods of time with a minimum of maintenance.

This is one of the reasons why Penn Ventilator Company has consistently selected DIEHL motors for its equipment. James T. Ellington, Penn Director of Purchases says: "We can't gamble with an inferior unit—a reliable motor is a necessity! DIEHL motors are trouble-free and well suited to all our requirements."

Here is another example of how DIEHL has cooperated with a progressive manufacturer to build a product of highest quality and proved reliability. With almost three quarters of a century of experience in the design and manufacture of motors, DIEHL is well equipped to help you solve your motor problems. We'll work closely with you to provide the right motor —at the right time—at the right price.

DIEHL MANUFACTURING COMPANY
Electrical Division of
THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

Diehl

☐ Please send me Consolidated Motor Catalog and Price List No. CE-10 3540

☐ Please have a DIEHL representative call

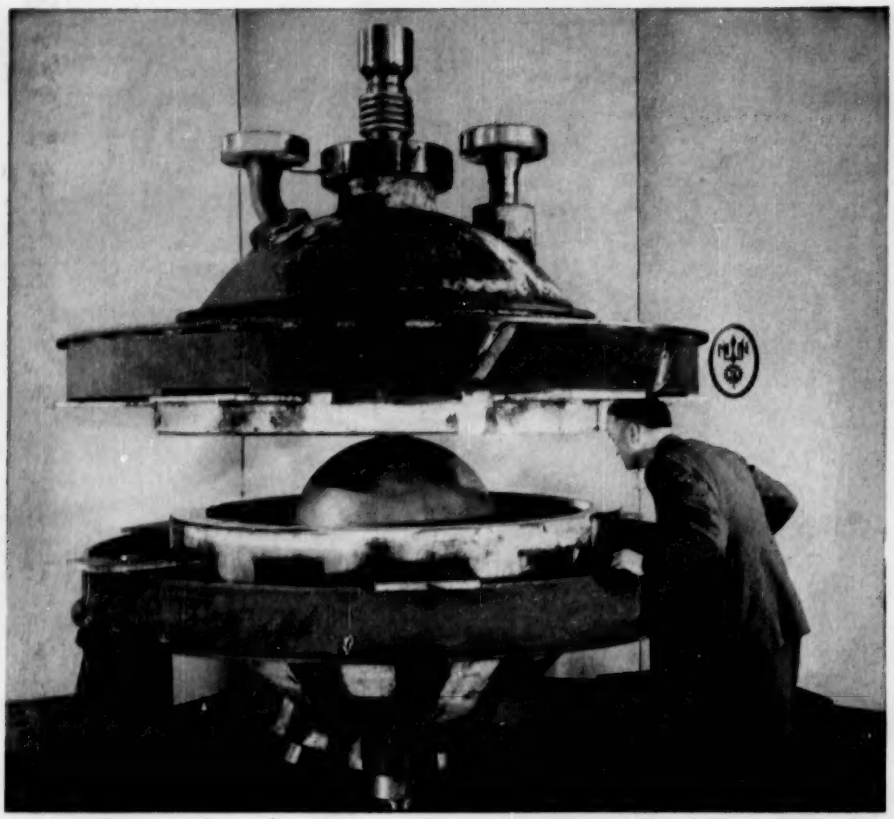
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Baltimore • Chamblee, Ga. • Charlotte • Chicago • Cincinnati • Los Angeles • Milwaukee • Needham, Mass. • New York • Philadelphia • Syracuse



Assembly of zircaloy-2 core tank and pressure vessel for Homogeneous Reactor Experiment No. 2 (HRE-2). The HRE-2 is a 5,000 KW plant designed for AEC by Union Carbide Nuclear Company. Newport News manufactured the 32" I.D. core vessel from 5/16" zircaloy-2, which involved the development of new welding techniques. The pressure vessel of Type 347 stainless clad steel is 4.4" thick, with an inner diameter of 60". Newport News designed the expansion joint between inner and outer vessels, and also produced the unusual coil-cooled blast shield for the unit.

Zircaloy-2 vessel produced by Newport News...for first two-region breeding homogeneous reactor

Never before had a pressure vessel been constructed from zircaloy-2.

Extremely active chemically, particularly at elevated temperatures, this alloy challenged fabrication. Unshielded, heated zircaloy absorbs atmospheric gases in quantities that render its corrosion and physical properties unsatisfactory. Newport News, however, achieved consistent, satisfactory welds by use of inert gas and novel, plant-developed shielding.

The core tank contains the fuel region where fissioning produces heat. The blanket or reflector region around the tank is confined by a pressure vessel of stainless clad steel.

Newport News, working with its suppliers, developed special fabrication and welding techniques, as well as forge and rolling methods to produce plates and forgings with required corrosion, nuclear and physical properties for both vessels.

Make Newport News your source for fabricated metal structures. See how this company's high integration of skill and facilities can help you. Our illustrated booklet, *"Facilities and Products"*, is yours for the asking. Write for your copy now.

Newport News Shipbuilding and Dry Dock Company
Newport News, Virginia

WILLIAMS REVERSIBLE IMPACTOR



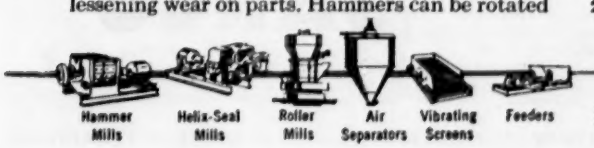
- 100% Impact Reduction
- No Friction Or Abrasion
- Unobstructed Discharge
- Less Upkeep Expense

Internal view showing manganese steel impact blocks, hammers and liners. Rugged, heavy steel plate construction. Extra large shafts are mounted in oversize bearings sealed in self-aligning housings.

Lower Cost Crushing And Grinding

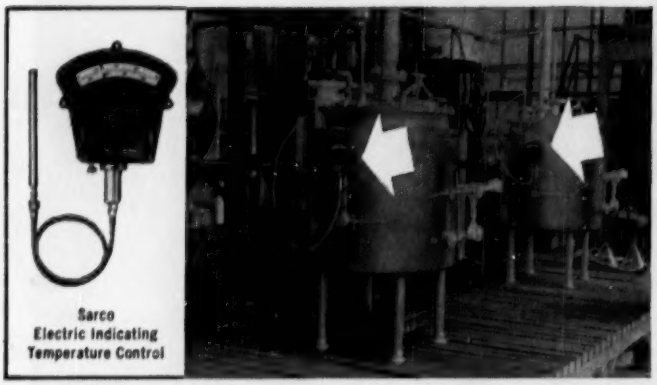
Heavy chemicals, fertilizer materials, limestone, shale and many other minerals can now be reduced to 1", ½" or even 20 mesh and finer with the Williams Reversible Impactor, at a lower cost per ton than has heretofore been possible. Reduction is entirely by impact. Material is fed *between* the hammers which throw it against the impact blocks setting up a repeated ricochet action and the reduction is entirely by impact with no wearing abrasive grinding action thereby lessening wear on parts. Hammers can be rotated in either direction, rotated to the right today, to the left tomorrow thereby giving double hammer life. Impact blocks adjustable for wear and fineness of product. Finished material is discharged freely which further lessens upkeep expense. A size for every job. Describe your work and let us tell you about one for your use.

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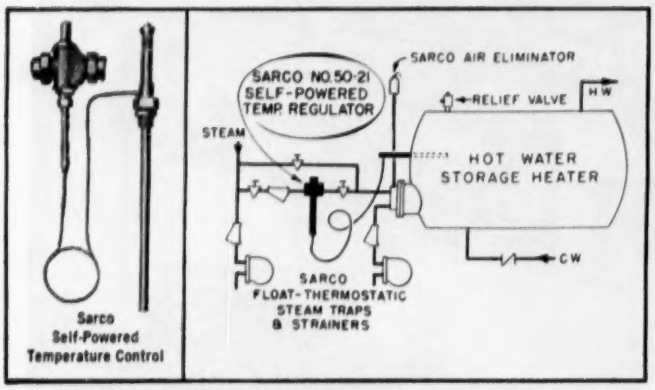


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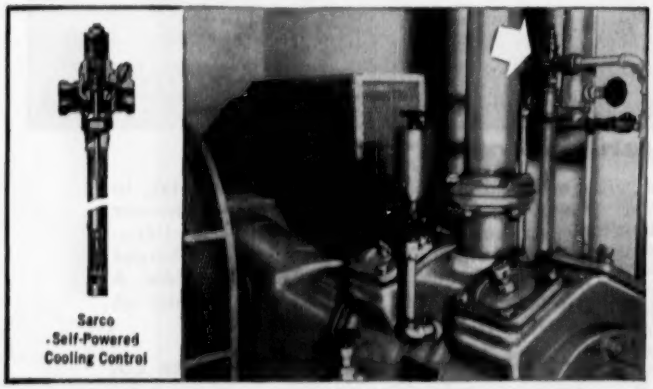
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GOT A COLOR REMOVAL PROBLEM?

Activated carbon can do the trick

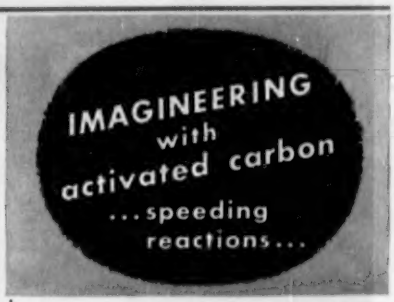
Do your salesmen have trouble selling your product, because its color isn't as good as your competitors?

Maybe we can help you. Darco® activated carbons are a possible remedy wherever color needs to be removed from a liquid. The impurities that cause color are often present in extremely small concentrations. Ordinary chemical methods of removing them are often too expensive, too inefficient, and occasionally too hazardous.



This is where activated carbon does an outstanding job. Many of the color-bearing materials that you want to get rid of are large, complex molecules that activated carbon can readily adsorb within its extensive internal pore structure. The process is extremely simple: just add carbon (it's relatively easy to figure how much is needed), agitate, and filter.

We've worked with chemists and production men in many different industries for several decades, helping them to figure out and apply ways to use Darco activated carbon for color removal. If you've got a problem of this sort, call on us.



Suppose you have a chemical reaction that goes too slowly, because the reactants are too dilute. To speed up the reaction, you'd have to increase concentrations.

Maybe adsorption by activated carbon can do this for you. Adsorption, by definition, occurs when there is a greater concentration of solute at a liquid-solid interface than in the main body of the solution. An adsorptive material, therefore, *increases* concentration of the materials adsorbed.

One catch to this idea: it only works if the materials you want to react are adsorbed by activated carbon. There are a lot of materials that fall into this category—large molecules, surface active agents and others. Our suggestion: try it and see. We'll be glad to send samples of Darco, and we'll be interested in your results.

How to select the grade of DARCO that's best for your use



You'll do a better job of decolorizing, deodorizing or purification with activated carbon when you use the grade of DARCO that best fits your individual requirements.

To match the varied needs of different adsorption applications, we make 12 different grades of DARCO activated carbon. Seven of these are powdered; five are granular. They give you a range of purity, particle size, type of activation and adsorptive power. One grade, for instance, is especially useful when you have a lot of color to remove. Another is outstanding in low retention—a useful quality when you're purifying a high-priced product.

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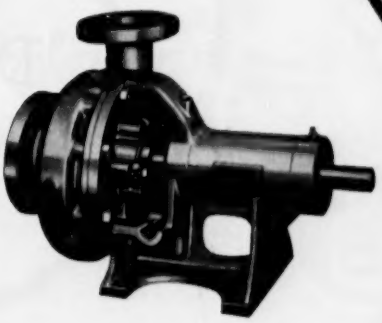
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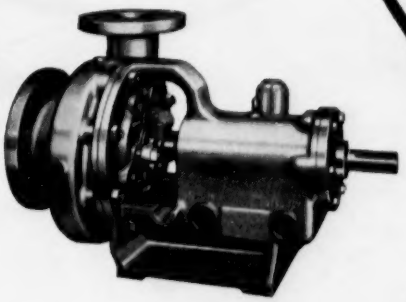
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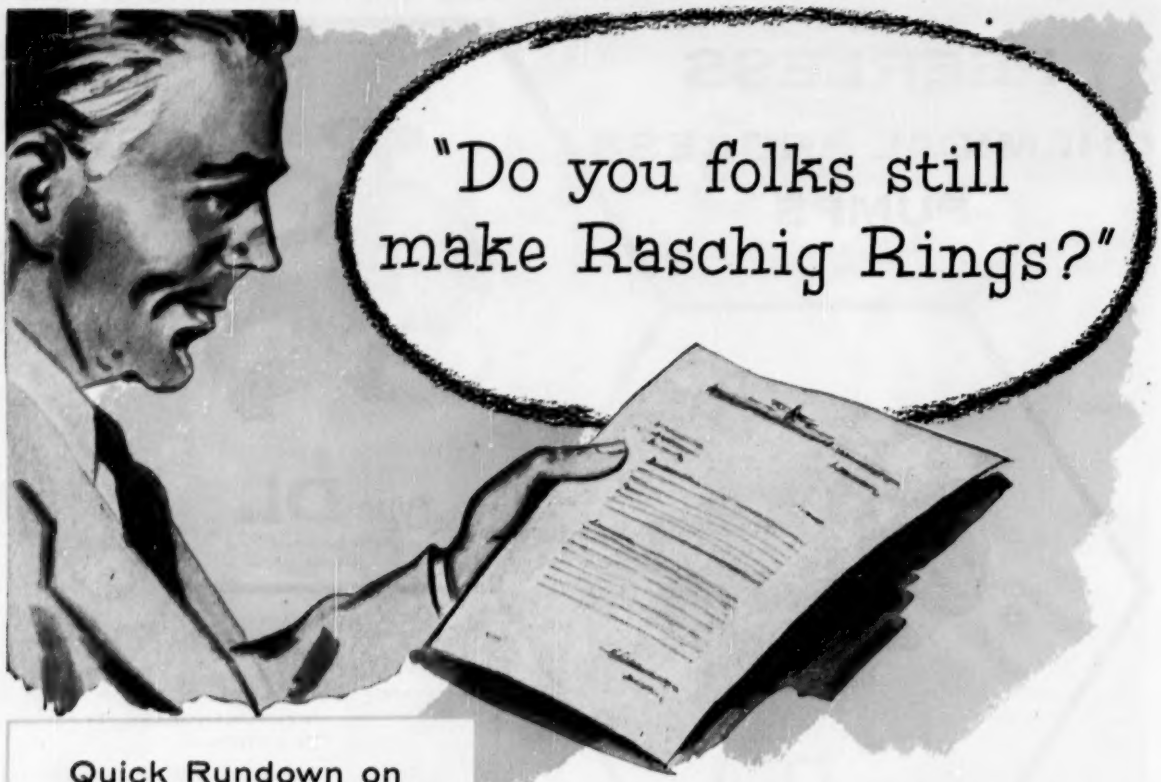
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Ceramic: We make them both in chemical stoneware and in white chemical porcelain in some sixteen sizes from ¼" O.D. to 6" O.D. – in standard or heavy wall.



Carbon: Eight sizes from ¼" O.D. to 3" O.D. These rings are all carbon, no soluble filler is used. Light, strong, resistant to severe thermal shock.



Metal: Available in fifteen sizes from ¼" O.D. to 3" O.D. in carbon steel, stainless steel and aluminum.

We'll admit the letter gave us a bit of a start. It went on to say: "In the last half dozen years all I've heard has been 'Intalox Saddles' . . . 'Intalox Saddles' . . . 'Intalox Saddles' . . . how much more efficient they are than rings. Can't I buy plain old-fashioned Raschig Rings any more?"

Sure, you can — and they're better than ever. As a matter of fact, we made and sold more Raschig Rings last year than ever in our history—more, even, than any other company in the business. Admittedly they don't measure up to Intalox Saddles or the newer metallic Pall Rings in performance — but many times the extra performance characteristics of the newer packings aren't needed, and the lower price of Raschig Rings makes them definitely worth using.

And there are new developments in Raschig Rings, too. In ceramics, the porcelain bodies are stronger, more resistant to spalling, possess better thermal shock properties. We have special bodies for better performance with alkalies. We make them in larger sizes, even up to six inches. And, of course, our porcelain bodies are completely iron-free, and show zero-absorption.

Yes — when the economics of the application indicate Raschig Rings — your one best source is, as always — U. S. Stoneware.

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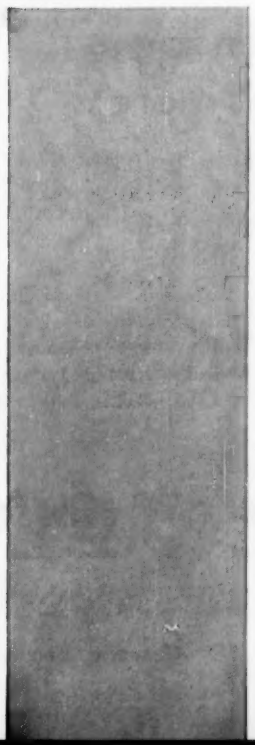
Chemical Engineering

Developments

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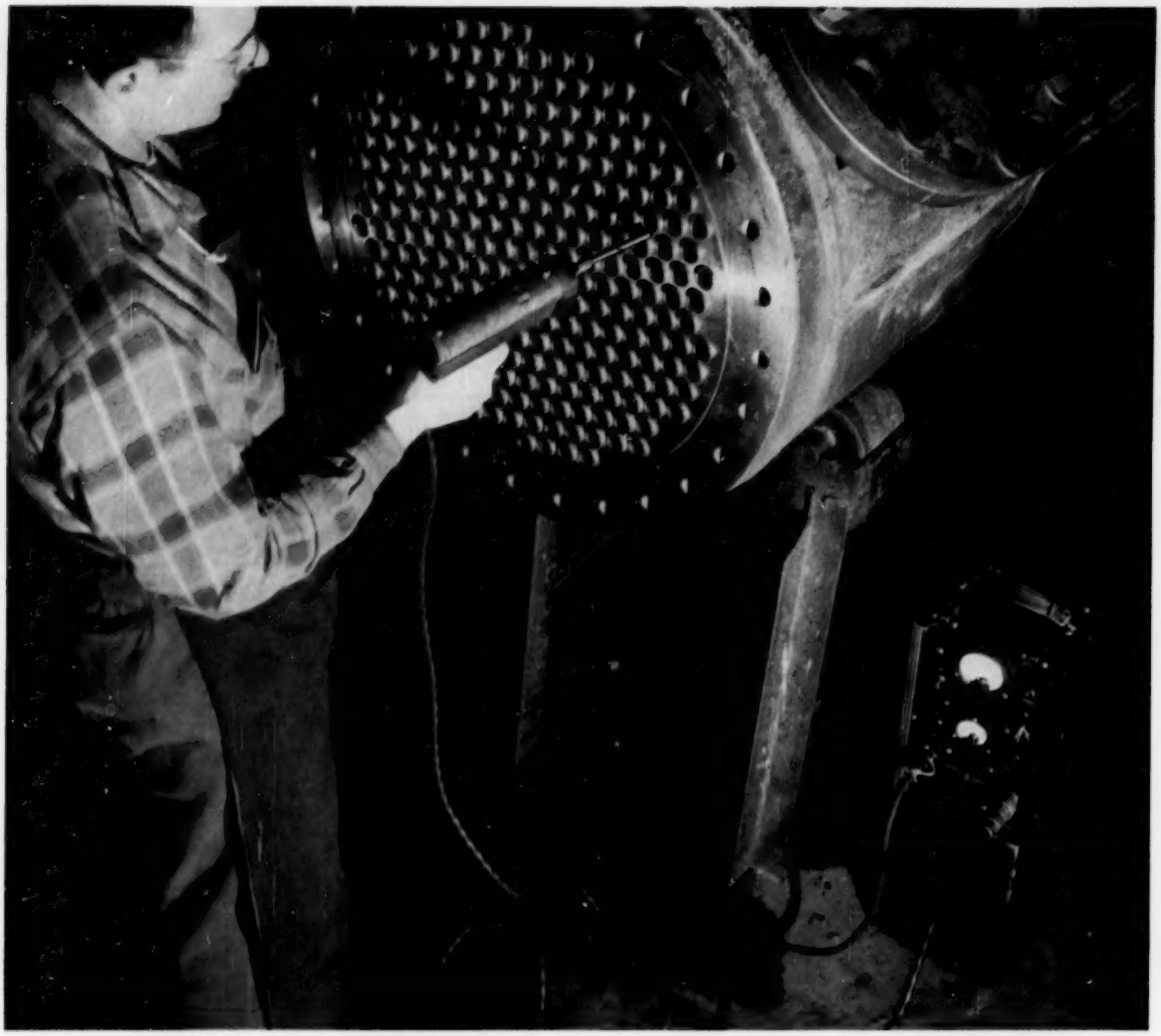
Two firms are turning them out: one, by a dissociation of hydrocarbon gas; the other, via carbonization of rayon.

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After careful analysis, you can design a control system based on a complete picture of your process operation.

More and more hot isotopes are on the way..... 206

They're already playing a big industrial role and the AEC says they'll soon save industry around $4 billion a year.



LEAK DETECTION . . . another reason why you get more for your dollar with p-k heat exchangers

The man above is "snooping" around a P-K heat exchanger to make sure it is leak free. The instrument he's using is an extremely sensitive leak detector which picks up even the slightest trace of a gas or vapor leak. For example, it can detect a leak so small that it would take a year for 1/100 of an ounce of gas or vapor to escape without discovery.

This leak detection test is only one of the many fabricating and testing procedures that make P-K heat transfer equipment the best you can have. For another example, every weld is x-rayed so that any flaw can be eliminated; each tube end is expanded electronically for the most perfect fit. Each unit's thermal rating is scientifically checked to assure that it will perform exactly at its rated capacity.

Precautions like these are the reasons why more and more processors, engineers and contractors are turning to P-K for their exchanger needs. P-K invites your inquiries about the design and fabricating of heat exchangers. Write, phone or visit The Patterson-Kelley Co., Inc., 210 Burson Street, East Stroudsburg, Pa.

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DEVELOPMENTS . . .

OCTOBER 1957

Chementator

C. H. CHILTON

✓ **Remarkable 78% conversion of heavy crude oil to gasoline will be claim to fame for Mississippi's new refinery a-building for Pontiac Eastern Corp. Fluor's design relies only on TCC, coker and alkylation units.**

✓ **Ion transport is Max Planck Institute's new tool for separating lithium isotopes. By applying direct current across U-tube filled with LiCl-$PbCl_2$ salt melt and fitted with LiCl cathode and $PbCl_2$ anode, it produced Li-7 for power cost of 12¢/gram, Li-6 for 71¢/gram.**

✓ **Freeport Sulphur plans to transport its Cuban nickel ore from mine to refinery in slurry form. First leg will be pipeline from mine to Mao Bay leach plant; leached concentrates will then be pumped aboard ship for transport to New Orleans refinery.**

Chemicals win MnO_2 from U.S. ore

Battery-active MnO_2 soon will be made chemically from domestic ore. At Henderson, Nev., American Potash & Chemical Corp. will shortly start a new 1-ton/day pilot plant.

Process uses abundant domestic materials to provide battery makers with an alternative supply of MnO_2. Material now made electrolytically depends upon dwindling supplies of African manganese.

Subjected to tests by AP&CC and Signal Corps at Fort Monmouth, N. J., this new MnO_2 exhibited high battery quality. In general, dry cells containing this material have greater capacities during shelf-life tests than batteries made with electrolytic manganese dioxide. AP&CC expects its MnO_2 to compete favorably in price with electrolytic MnO_2.

In the new process, manganese sulfate reacts with sodium chlorate at 200 F. in the presence of dilute H_2SO_4 to form rho-phase crystalline MnO_2, rather than gamma crystal associated with the electrolytic grade.

Super phos acid adds oomph to fertilizers

Not to be outdone by high-energy-fuel technologists, TVA fertilizer experts now are packing more wallop into liquid plant foods. Using a new superphosphoric acid (76% P_2O_5), TVA's chemical development group has boosted concentration of fertilizer solutions from 8-24-0 to 11-33-0 (N, P, K). Commercial-scale ammoniation underwent trial this summer at West Kentucky Liquid Fertilizer Co., Hopkinsville, Ky.

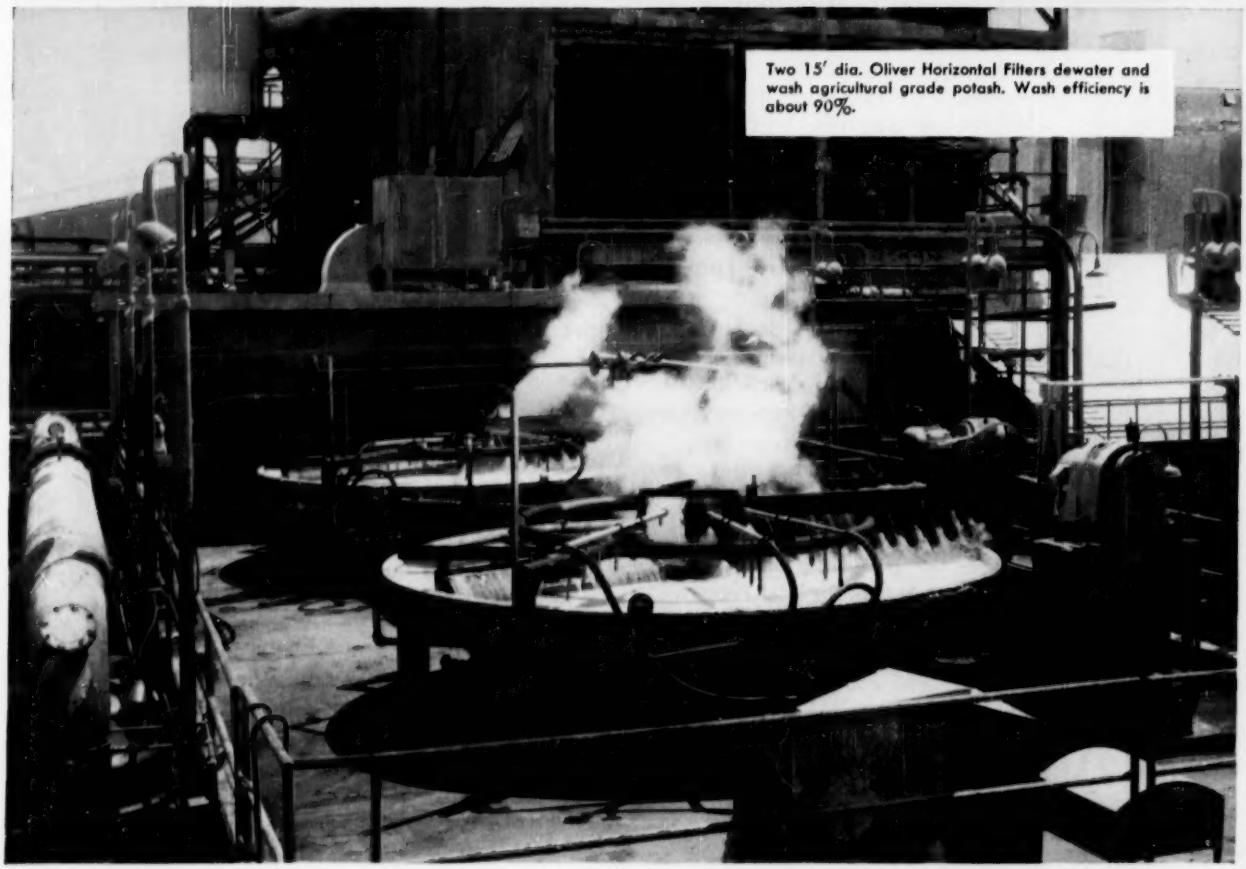
Further treatment of 11-33-0 and 12-36-0 solutions with urea or urea-ammonium nitrate solutions and potassium chloride produces 10-10-10, 9-18-9, 7-21-7 and 5-15-10 solutions. At storage temperatures of 32 F. and above and periods up to one week, these solutions do not salt out.

Superphosphoric acid also has been used

(Continued on page 140)

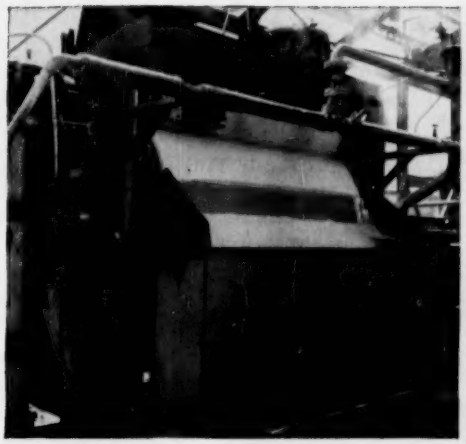


This 60′ dia. Dorr Thickener is used to thicken borax ahead of two 6′ x 6′ Oliver Filters.

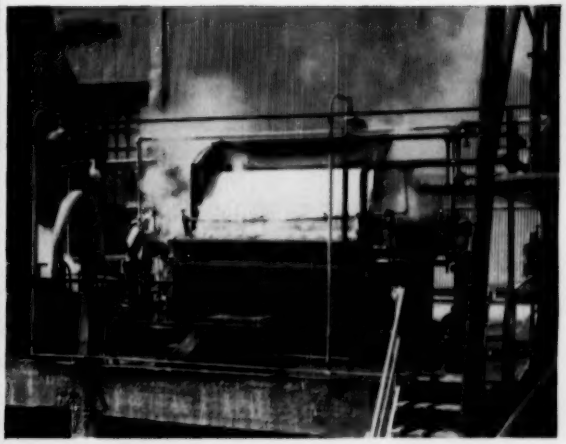


Two 15′ dia. Oliver Horizontal Filters dewater and wash agricultural grade potash. Wash efficiency is about 90%.





This 6′ dia. by 8′ fabricated stainless steel Oliver Salt Type Filter handles about 200 TPD of sodium bicarbonate. Note how clean the snap blow leaves the screen. A 2″ thick cake is discharged at 28% moisture with the aid of press rolls.



Another 6′ dia. by 8′ fabricated stainless steel Oliver Salt Type Filter handles approximately 100 TPD of sodium chloride. There are nine of these units in this section of the Trona plant operating on brine at 190°-200°F. Steam blow is used to keep the cover clean and snap blow discharge is very effective.

DORR-OLIVER TECHNIQUES

at American Potash & Chemical



TRONA

Tonnage producers of potash, sodium carbonate, borax, and sodium sulfate, American Potash & Chemical Corporation makes skillful use of Dorr-Oliver equipment and methods at their giant Trona, California plant. D-O Thickeners, Filters, and Classifiers are used in virtually every wet processing step in the flowsheet. On the Filters alone, over forty different units are installed . . . Oliver Drums, Oliver Salt Type, Horizontals and Sweetlands.

For the Process Industries, Dorr-Oliver offers a complete and integrated service. Well-designed equipment, as installed at AP and CC, is an important part of this service. But if your processing needs involve laboratory and pilot plant testing, flowsheet preparation, economic analysis or complete plant design and construction, we can also be of help. For a complete picture of the scope of the Dorr-Oliver technical service write for a copy of Bulletin No. 7003. Dorr-Oliver Incorporated, Stamford, Connecticut.

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to produce concentrated solid fertilizers. And trial production indicates that, when furnishing 10% of the P_2O_5, it may be a good sequestering agent for making 8-24-0 solution with wet-process acid. More work is needed to prove this out.

Acid in the superphosphoric category, analyzing 76% P_2O_5 (105% H_3PO_4), contains approximately 49% orthophosphate, 42% pyrophosphate and the remainder higher polyphosphates. Even though P_2O_5 content lies midway between solid orthophosphoric and pyrophosphoric acids, the superphosphoric acid remains liquid at room temperature.

Water content is only half that of regular furnace acid; it is much less corrosive to metals and alloys. Cost per unit of P_2O_5 is essentially equal to regular acid.

Currently, TVA produces superphosphoric acid in the same plant used for conventional furnace acid, sells limited quantities to fertilizer makers to encourage its use. Acid is produced in a hydrator by hitting combustion gas from phosphorus burner with water spray. A venturi scrubber backing up the hydrator captures any acid carried over.

New H_2 refining route for benzene

Bowing to coke-oven operators' whetted curiosity, licensing agent Newton Chambers & Co. (Thorncliffe, England) has now sketched out, albeit broadly, the flowsheet of that new process for hydrogen refining of coke-oven benzene developed by Britain's Coal Tar Research Assn. (*Chementator*, Sept. 1957, p. 139).

Crude benzene and compressed hydrogenation gas, first preheated, flow through the tubes of a shell-and-tube exchanger, where the benzene is vaporized. Mixed gas stream then feeds to a distillation tower, where heavy wash oils carried in benzene stream are cut out.

Overhead from tower, further heated in an oil-fired furnace, goes to a converter filled with metal-oxide-on-alumina catalyst. There, sulfur compounds, gum-forming olefins and color-forming bodies hydrogenate.

Newton Chambers has run process with both coke-oven gas and straight hydrogen in its 500-gal./day pilot plant. With coke-oven gas (45-55% H_2 content), hydrogenation takes place at 450 psi. and 750 F.; with hydrogen, pressures run under 400 psi. (These pressures stand at the low end of the range given for H_2 refining routes, as Esso's Hydrofiner, to be used by coke-oven operators in U. S.) Current work indicates process is suited to naphtha with only minor revisions.

Solvent shortens route from ore to UF_4

A short cut may be forthcoming in production of uranium tetrafluoride, key intermediate in making uranium metal and uranium hexafluoride. Operating with funds from the AEC Raw Materials Div., Dow Chemical's Pittsburg (Calif.) laboratory has worked out a solvent extraction route to high-purity UF_4. If adopted, Dow's development would eliminate several current steps, permit producing UF_4 from ore in one continuous process.

Under present practice, Colorado Plateau mills produce "yellow cake" (75% U_3O_8). To ship it east for conversion to UF_4 requires sizable precipitation, filtration and drying operations.

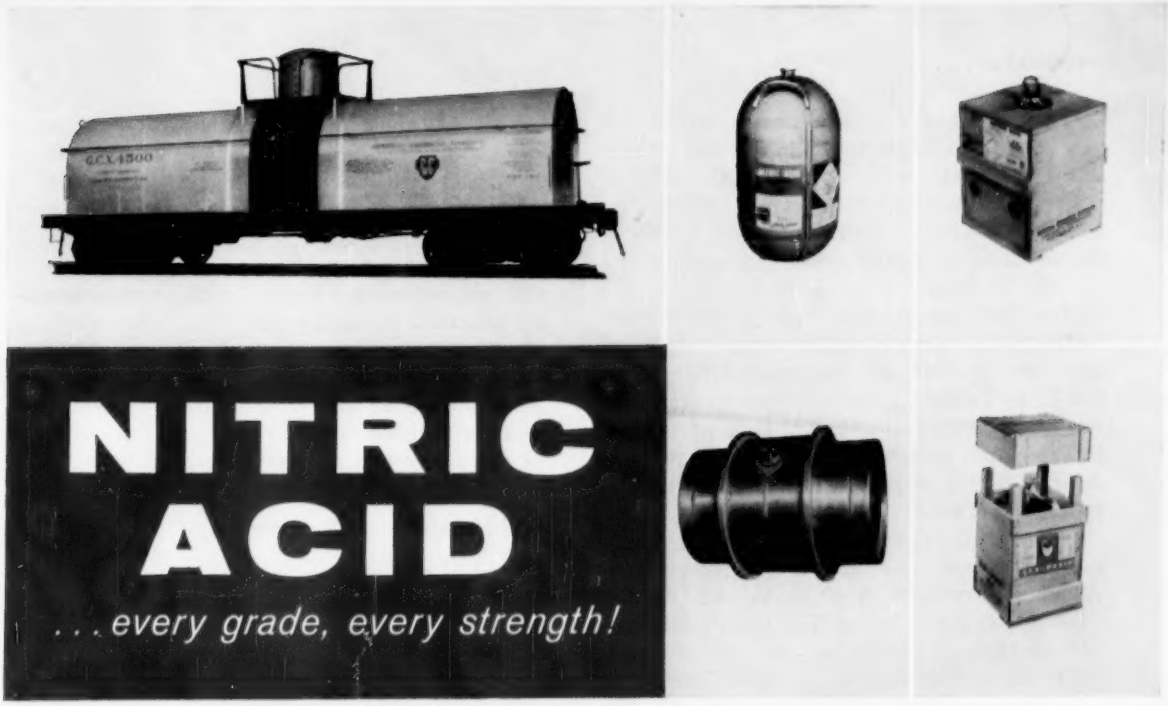
With Dow's process, uranium, reduced in valence by iron, aluminum or electrolysis, is extracted from high-chloride liquors as a uranium chloride anion complex. Undisclosed extracting compound is highly specific for the uranium without picking up other elements present in the solvent extraction or ion exchange chloride liquors. Selectivity is so high that UF_4 precipitated from the solvent phase by addition of HF meets AEC's exacting specifications.

New fuel cell lands first operating job

One more scientific curiosity became a practical reality with public unveiling of an operational fuel cell at the Army's Electronic Proving Ground, Fort Huachuca, Ariz., on Sept. 20. Operating at 120-140 F. and essentially atmospheric pressure, device is first fuel cell able to convert chemical energy of the hydrogen-oxygen reaction directly into economic kilowatts of power. Foreign developments in this field (*Chem. Eng.*, Feb. 1956, p. 110; Sept. 1955, p. 136) require higher pressures and temperatures.

First significant use of the new cell provides silent electric power to operate the Signal Corps' "silent sentry" radar set. Military communications systems, mobile power units and standby power plants are but a few of the applications predicted by National Carbon Co., developer of the unit.

(Continued on page 142)



General Chemical Production Facilities Assure Uninterrupted Service

To keep pace with constantly increasing demands, General Chemical has recently expanded the capacity of its already large-scale Nitric Acid facilities. Today, three major plants—in Buffalo, N. Y., Newell, Pa. and Hedges, Wash.—provide steady, dependable customer service.

As a prime source of supply for Nitric Acid for more than 50 years, General offers the largest selection of grades and strengths on the market. It has a knowledge of the product, its properties and applications that can be extremely helpful to every user. This accumulated experience is at your service whether your interests are in basic industrial uses or in such advanced applications as rockets and missiles.

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Among future possibilities is use of the fuel cell to produce commercial electric power. But to compete with conventional systems, it needs inexpensive hydrogen—even though fuel-cell efficiencies lie in the 65-80% range, double those of steam power systems.

Or, the fuel cell could team with solar or nuclear systems to utilize energy more effectively. Solar energy could decompose water into hydrogen and oxygen for later (nighttime) use in fuel cells. Decomposition of water by nuclear energy, unwanted in current nuclear power plant designs, could actually become desirable as a source of feed hydrogen and oxygen for fuel-cell operation.

National Carbon's cell design groups a number of specially catalyzed, hollow, porous carbon electrodes within a sealed cell. Hydrogen and oxygen flow into the hollow electrodes, diffuse through the porous carbon and react with the surrounding KOH electrolyte.

Ideally, a fuel cell is a high-current, low-voltage device. Power characteristics can be controlled by varying number and size of cells.

H_2 distillation takes D_2O spotlight

Two developments, coming within a week of each other in August, sharpen commercial attention on low-temperature distillation of hydrogen for the production of heavy water:

• National Bureau of Standards started building a 60-lb./yr. heavy water pilot plant at Boulder, Colo., due on stream next month, that centers on a liquid-hydrogen still.

• Farbwerke Hoechst (Germany) reported that its $1.7-million, liquid-hydrogen-fed installation, two years in the making, is now about ready to begin production of 12,000 lb./yr. D_2O.

Hydrogen distillation has been widely regarded as the most economical route to heavy water. Various sources give these comparative process costs: Water distillation, $285/lb. D_2O; catalytic exchange, $72/lb.; hydrogen distillation, $61/lb. But processing problems, chiefly lack of column design data and experience in handling —250 C. liquid H_2, have discouraged all but desultory activity to date.

Heart of NBS plant is a copper-and-brass primary distillation column, 10 ft. tall by 6 in. dia. It's fitted with 30 actual plates, made of 40-mesh wire screen, spaced 4 in. apart. Some 18.5 scfm. of liquid hydrogen, containing 0.03% hydrogen-deuterium molecules, feeds the column. Distillation gets pure H_2 overhead and a bottoms stream of 3% HD.

Secondary distillation produces a bottoms stream containing 95% HD, which is catalyzed to deliver a stream of 25% pure deuterium to final distillation column. Bottoms from this column is pure D_2 that's oxidized to deuterium oxide (heavy water).

Hoechst's big commercial plant underscores the economical feasibility of the hydrogen-distillation route. Entirely privately financed, Hoechst expects to sell its product at the current world market price of $109/lb.

Gold platers strike new paydirt

Key to a new immersion process for 24-karat gold plating is a water-soluble organic gold complex developed by Baker & Co., Newark, N. J., and now ready for commercial markets.

In the new process, dubbed Atomex, no external source of electric current is used. Object to be plated is simply immersed in the warm bath; plating is the result of galvanic interaction between the base metal being plated and the gold ions in solution. Deposition of gold continues as long as the solution has access to the base metal. As soon as the gold has formed a completely impervious, nonporous coating (usually in less than 5 min.), plating action ceases automatically.

With patent on composition of the plating solution still pending, Baker declines to disclose its specific chemical identity. According to inventor Harold Robinson, the gold compound, while involving a cyanogen complex, contains no free cyanide.

Because the dry salt is unstable, Baker will be marketing it as a solution containing 2½ oz. of gold per liter. Price will be in the range of $43-52/oz. of contained gold, competitive with solid gold bar used in electroplating processes. However, Atomex is claimed to use 25-35% less gold than electroplating to get coverage of comparable quality.

Process was put into commercial use this summer by Dodge, Inc., Newark manufacturer of gold-plated trophies. While consumer products will likely be the big initial market for Atomex, Baker is also eyeing potential industrial uses. One of these is the gold-plating of printed circuits, already being explored by Swartout Co., Cleveland.

For more on DEVELOPMENTS.....144



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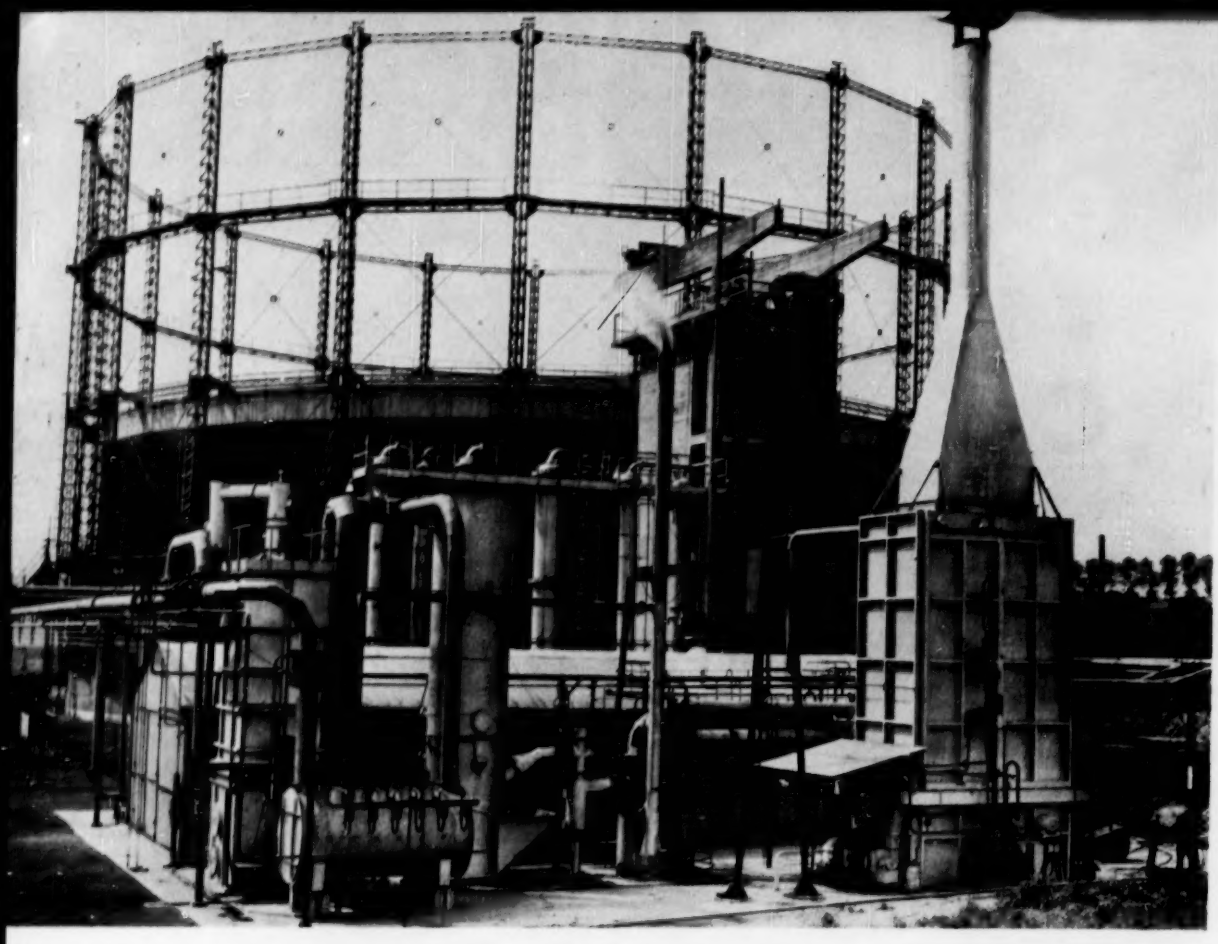
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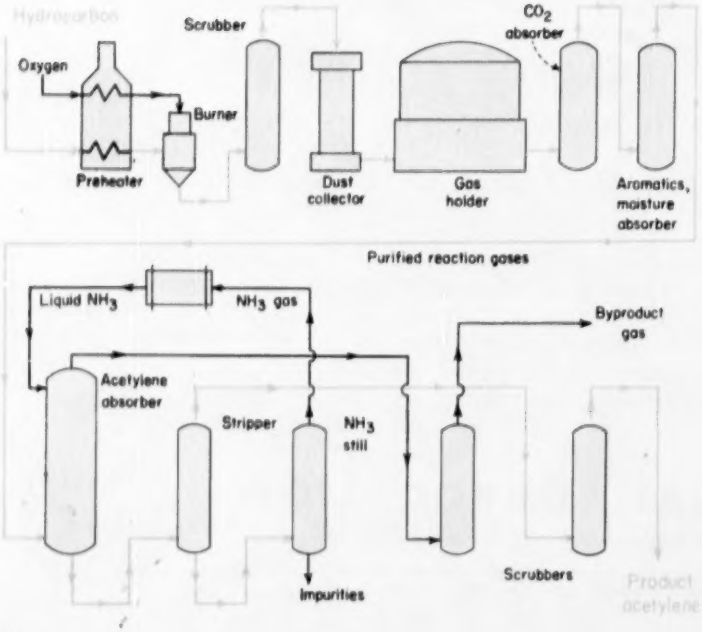
CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

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SHELL



Process Improvements Enhance Outlook for



New burner design and liquid ammonia solvent deliver low-cost acetylene via partial oxidation of hydrocarbon feed.

Adding a couple of new twists to a now-well-established process scheme, the Belgian firm of Societe Belge de L'Azote (SBA) has come up with its own version of acetylene manufacture via partial oxidation of hydrocarbons.

According to SBA, its new process is more economical, easier to operate and gives a higher-purity product than any other process now used. A new burner design which eliminates carbon deposition, coupled with an effective liquid ammonia solvent for acetylene recovery,



Petrochemical Acetylene

highlight the SBA developments.

Versatile process can produce acetylene from a wide range of gaseous or liquid hydrocarbon feeds (natural gas, propane, butane, heavy oils, etc.). SBA has licensed several U. S. engineering firms to market process in this country. Blaw-Knox, one of these, estimates cost of a 60-ton/day plant at $5.3 million, exclusive of oxygen facilities. (Process consumes 5.2 tons oxygen per ton of acetylene.)

▶ **Up and Coming** — SBA has been grooming its process for quite a while. A pilot plant was built at Liege, Belgium, in the early 1930's. In 1953, a 2-ton/day semicommercial unit (*see photos above*) went up in Brussels. Now SBA is building a 20-ton/day plant for Houllieres du Bassin de Lorraine at Carling, France.

Earlier this year SBA brought the process to this country, but as yet no U. S. producer has bought the SBA flowsheet. Diamond Alkali reportedly was interested, but no definite decision has yet been announced.

▶ **New Solvent**—Used to absorb acetylene from cracked reaction gases, economical liquid ammonia solvent is an SBA first. Other processes to date have depended on relatively expensive organic solvents, such as dimethyl formamide or butyrolactone, or on refrigerated methanol (*Chem. Eng.*, June 1956, p. 114-5).

Not only is liquid ammonia inexpensive, it is also highly selective. At the low temperature used for absorption (exact temperature is secret but is obviously below −28 F., atmospheric boiling point of ammonia), solubility of acetylene in ammonia is 20 times greater than in acetone, the usual absorbent for bottled acetylene. And ammonia provides a clean separation from troublesome impurities. It doesn't absorb any ethylene present in reaction gas; only acetylene and polymers of diacetylene go into solution. Convenient spread of boiling points does the rest; ammonia's boiling point lies between that of acetylene and the dissolved higher acetylene polymers. Therefore, one stripping step recovers acetylene and a second regenerates the ammonia solvent.

▶ **No-Carbon Burner** — Innovation number two for SBA is a burner design which effectively eliminates carbon deposits. Older burners with ceramic burning blocks and other refractory materials have been plagued with carbon buildup, necessitating use of mechanical cleaning devices and all-too-frequent shutdowns.

SBA claims to have licked this problem with an all-metal, refractory-less burner in which a cylindrical sheet of water runs

parallel to, and surrounds, the reacting gas stream. The water cools the metal parts while washing away carbon deposits, eliminating need for mechanical cleaning.

▶ **Flowsheet Rundown** — Here's how the SBA system operates:

Reaction — Hydrocarbon feed (gas or liquid) is preheated as high as composition will allow. Separately preheated oxygen is mixed with hot feed in the burner, and feed is partially oxidized. (A different version of burner design is used for hydrocarbons higher than methane.) Reaction gases are quenched in a water spray and then pass through electrostatic precipitators to remove carbon particles.

Purification—Two purification steps follow. CO_2 is removed by scrubbing with amine solutions or other specific absorbents. Aromatics, heavy acetylene homologs and moisture are removed in a cold methanol scrubber.

Absorption—Cool, purified gas is fed to the ammonia absorber. Acetylene and polymers are absorbed in liquid ammonia at 1 atm. pressure; hydrogen, carbon monoxide and ethylene pass through and are vented through a water scrubber to remove entrained ammonia. Ethylene may be recovered by liquefaction; the residual CO-H_2 gas is suitable for ammonia or methanol synthesis or can be used for its fuel value.

Recovery—Rich solvent from absorber flows to a stripper, where acetylene is distilled off under pressure. After scrubbing with water to remove entrained ammonia, acetylene as high as 99.8% purity is obtained.

Bottoms from the acetylene stripper are distilled to regenerate the solvent ammonia. Regenerated ammonia is already under pressure, so it doesn't have to be compressed before liquefaction and recycle.

Ammonia solutions from the scrubbers can be distilled to recover ammonia or be used directly in the manufacture of nitrogen solutions for fertilizers.

▶ **Gives These Results** — SBA claims its process scores on these four points:

Lower costs — Absorption at atmospheric pressure eliminates the need for compressing the reaction gases, reduces equipment costs; low-cost ammonia saves on solvent expenses. Absorption or mechanical refrigeration system can be used, depending on economics involved.

Ease of operation—The two distinctive process features practically eliminate plugging of passages, thus slashing shutdown time. Patented-design burner avoids soot buildup and reduces maintenance costs; troublesome diacetylene polymers are held in the solvent, effectively eliminating this source of plugging.

CO_2-free residual gas — Removal of CO_2 before recovering residual gas increases its heating value (390 Btu./cu. ft.) and thus boosts its value as a fuel. Or, CO_2 removal renders it more suitable for direct use as a synthesis gas.

Higher-purity acetylene—Ammonia solvent eliminates difficulties encountered with higher acetylenes and consequently yields a cleaner product.

Gulf Oil to Isomerize For Higher Octane

Gulf Oil Co. is seeking bids for construction of the world's first full-scale hydroisomerization unit. The 12,000-bbl./day octane booster is slated for the Port Arthur, Tex., refinery, will primarily upgrade pentane in natural and straight-run gasolines.

Hydroisomerization will join catalytic reforming in the refiners' bag of tricks. Gulf officials said new process would up leaded octane number of pentane stock from 88 to around 106, that of hexane portion from 65 to 95 or higher.

General technology of isomerization is receiving serious attention from many oil refiners (*Chem. Eng.*, Nov. 1956, p. 128). Differing considerably from catalytic reforming, isomerization raises the technological and economic ceiling placed on gasoline octane ratings. Operation is flexible, yields are high and, most important, it upgrades the C_5, C_6 and C_7 fractions which resist reforming.

Convention Calendar

American Oil Chemists' Society, symposia on soaps, detergents, color specifications and measurements, Netherland Hilton Hotel, Cincinnati, Ohio, Sept. 30-Oct. 2.

National Assn. of Corrosion Engineers, south-central regional meeting, Municipal Auditorium, Oklahoma City, Okla., Oct. 1-4.

European Federation of Chemical Engineering, congress, Zurich, Switzerland, Oct. 3.

American Gas Assn., convention, Kiel Auditorium, St. Louis, Mo., Oct. 7-9.

Technical Assn. of the Pulp and Paper Industry, 12th annual plastics-paper conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, Oct. 7-9.

Fourth National Symposium on Vacuum Technology, Hotel Somerset, Boston, Mass., Oct. 9-11.

Salesmen's Assn. of the American Chemical Industry, sixth annual sales clinic, Hotel Roosevelt, New York, N. Y., Oct. 14.

Plant Layout Technical Workshop, fifth semiannual session, Greater Pittsburgh Airport Hotel, Pittsburgh, Pa., Oct. 14-18.

American Institute of Chemical Engineers, New York Section, all-day symposium, Hotel Statler, New York, N. Y., Oct. 22.

Assn. of Consulting Chemists and Chemical Engineers, annual meeting, Hotel Belmont Plaza, New York, Oct. 22.

Trade Fair of the Atomic Industry, in conjunction with annual atomic industry conference and winter meeting of American Nuclear society, New York Coliseum, New York, N. Y., Oct. 28-31.

Second World Metallurgical Congress, 39th National Metal Exposition and Congress, Hotel Sherman and Palmer House, Chicago, Ill., Nov. 2-8.

LUMMUS

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PITTSBURGH COKE DOUBLES ITS PHTHALIC CAPACITY

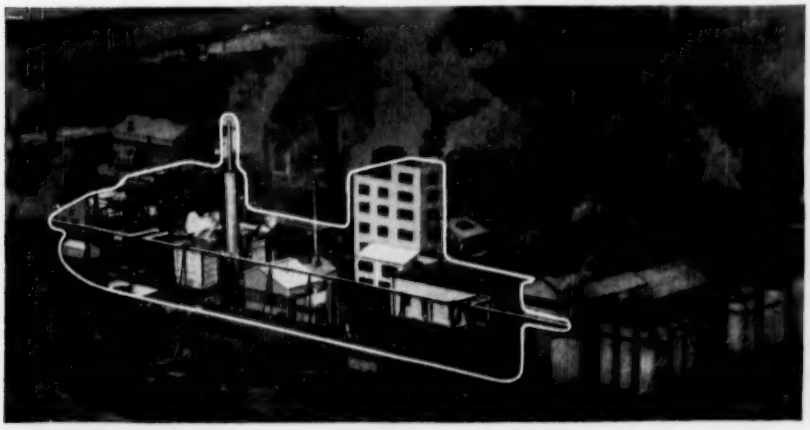
Lummus Engineers and Constructs $3 Million Plant

The recent start-up of Pittsburgh Coke & Chemical Co.'s new phthalic anhydride facilities marks another step in this company's expansion in the chemical field. Engineered and built by The Lummus Company, the new plant was integrated with existing facilities of the company's Industrial Chemicals Division on Neville Island in the Ohio River below Pittsburgh.

Since the new plant was an expansion of existing facilities, interference with current production during construction had to be kept to a minimum. This was done by close coordination between Pittsburgh Coke and Lummus engineers at all stages of the job.

The plant has a number of outstanding features. The Lummus-designed instrumentation system includes thermocouples which – at the push of a button – in the control room – travel to any desired point in the reactor as indicated on the control board. This instrumentation permits convenient checking of temperatures throughout the reactor bed. Molten salt circulated around the reactor maintains the desired temperature of reaction.

Current Lummus projects include plants for the manufacture of ethylene, ethylene oxide, pulp and paper, beryllium metal, ammonia and food products. Every Lummus project reflects the experience of many specialists in the process fields. This experience is ready to work for you – to design, engineer and build new or expanded facilities. If you have such a project in mind, discuss your plans with Lummus.



Outlined in white are the expanded phthalic anhydride facilities engineered and constructed by Lummus for Pittsburgh Coke & Chemical Co.

The Lummus Company, 385 Madison Avenue, New York 17, New York. *Engineering and Sales Offices and Subsidiaries:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Engineering Center:* Newark, N. J.



Group award will recognize rise of chemical engineering in extractive metallurgy of the Atomic Age.

To Honor Pioneering Across New Frontiers

BY ALMOST unanimous vote of the Award Committee of 90 senior educators under the chairmanship of Dr. Walter G. Whitman of M.I.T., the 1957 Award for Chemical Engineering Achievement sponsored by this magazine since 1933, will recognize the pioneering application of chemical engineering principles and processes in extractive metallurgy. Approximately 75 organizations in industry and government will share in the group awards to be presented during the Chemical Exposition in New York, December 2-6.

The recent rise of "chemical" metallurgy, sparked by newer techniques for processing uranium and other Atomic Age metals, promises greatly increased production of purer metals, often from previously uneconomic sources. The use of ion-exchange, solvent extraction, chemical precipitation, gas absorption, etc., has opened a half-billion dollar market for chemicals and processing equipment.

With this trend has also come many challenging opportunities for chemical engineers in research, development and application of older as well as newer technology. One industry-experienced professor confidently predicts that this renaissance of metallurgy may ultimately rival the chemical and petroleum industries as chemical engineering employers.

The citations of the 1957 Award Committee were somewhat arbitrarily limited to the "newer" Atomic Age metals: Uranium, plutonium, zirconium and hafnium, tantalum and niobium, lithium, boron, beryllium, thorium and the rare earth metals. Also included, — since they are primarily products of chemical metallurgy as well as important to the nuclear industry — are the three "older" metals: Aluminum, nickel and titanium.

To honor these major achievements on behalf of the chemical engineering profession, this magazine will sponsor another Award Dinner in the grand ballroom of the Waldorf-Astoria hotel in New York on Tuesday, December 3. On that occasion, Chairman Whitman will present appropriate certificates of award to the presidents or designated representatives of the recipient organizations. Brief talks will be made by several internationally known authorities as well as by industry and government leaders in chemical and metallurgical engineering.

Tickets for the Award Dinner will be available from *Chemical Engineering's* Editorial Department after October 15, with table and seating reservations accepted in order of their receipt prior to November 1. It is expected that more than a thousand engineers and executives will attend this climaxing event of the 26th Exposition of the Chemical Industries—the first to be held in New York since 1951.

Following are the organizations cited by the Committee for the 1957 Awards for Chemical Engineering Achievement in the extractive metallurgy of the Atomic Age metals:

1957 Award Winners

Allied Chemical & Dye Corp.
New York, N. Y.
Uranium (General Chemical Division)
Titanium (Allied-Kennecott Titanium Corp.)

Aluminum Company of America
Pittsburgh, Pa.
Aluminum

American Cyanamid Co.
New York, N. Y.
Uranium

American Potash & Chemical Co.
Los Angeles, Calif.
Lithium and Boron

Ames Laboratory, U.S.A.E.C.
Ames, Iowa
Uranium, Thorium and Rare Earths

Anaconda Co.
New York, N. Y.
Uranium

Argonne National Laboratory
(University of Chicago, contractor)
Lemont, Ill.
Uranium and Zirconium

Battelle Memorial Institute
Columbus, Ohio
Uranium and Titanium

Beryllium Corp. of America
Reading, Pa.
Beryllium

(Continued)

ideas

new ways to solve problems — with chemicals

THERMOSETTING RESINS MADE FROM CONIFEROUS BARK are said to be good substitutes for, or additives to, phenol aldehyde resins. The bark is treated with sodium hydroxide, then reacted with formaldehyde to form the resin. A paraformaldehyde solution in water or formalin, with varying amounts of alkali, is stirred in to form a smooth paste suitable for plywood adhesive. It is reported that pre-extraction of the bark with benzene produces a superior resin, as does the addition of 20% by weight of a phenol or 3,5-xylenol.

UREA AND THIOUREA SEPARATE CERTAIN ORGANIC COMPOUNDS. Urea forms preferential adducts with organic compounds having straight chains of 6-50 carbon atoms; thiourea forms adducts with branched and cyclic compounds having 3-50 carbon atoms. Low-boiling aliphatic alcohols are used as solvents. Adducts form at any temperature from 0-100 F.; 80 F. is preferable.

A PATENTED PROCESS FOR PURIFYING MOLASSES employs methanol and an acid to separate out undesirable cations. One part by weight of molasses is mixed with up to two parts by weight of methanol. An acid is added which forms salts with the cations present; these salts are insoluble in the molasses-methanol mixture. Enough acid is added to give a pH of 1-5 at 20 to 80 C. Liquid and solid phases are then separated and a pure sugar is crystallized from the liquid phase.

PRACTICALLY PURE ACETYLENE is obtained from crude acetylene streams by a recently developed system. A recoverable ammonia solution removes carbon dioxide; passage through a heat exchanger removes aromatic hydrocarbons and water. The acetylene and its homologs are then dissolved in liquid ammonia, and the solution is fractionated. Practically pure acetylene is produced in the head fraction.

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Information appearing here is published as a service to readers. Although we do not make the end products mentioned, we can supply you with these basic chemicals:

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sodium nitrate • methanol • nitrogen solutions • nitrogen tetroxide
fertilizers and feed supplements.

Blaw-Knox, Chemical Plants Division
Pittsburgh, Pa.
Uranium; Nuclear Metals

Blockson Chemical Co.
Joliet, Illinois
Uranium

Brookhaven National Laboratory
(Associated Universities, Inc., contractor)
Upton, L. I., New York
Uranium

Brush Beryllium Co.
Cleveland, Ohio
Beryllium

Callery Chemical Co.
Callery, Pa.
Boron

Carborundum Metals Co., The
Akron, N. Y.
Zirconium

Catalytic Construction Co.
Philadelphia, Pa.
Uranium and Zirconium

Chemical Construction Co. (Ebasco Services, Inc.)
New York, N. Y.
Uranium and Nickel

Climax Uranium Co.
Grand Junction, Colorado
Uranium

Columbia-National Corp.
Cambridge, Mass.
Zirconium and Hafnium

Columbia-Southern Chemical Corp. Corp.
Pittsburgh, Pa.
Titanium

Crane Co.
Chicago, Illinois
Titanium—Cramet (with Republic Steel Co.)
Thorium & Rare Earths—Heavy Minerals Co., Inc. (with Vitro Corp. of America)

Dorr-Oliver, Inc.
Stamford, Conn.
Uranium; Nuclear Metals

Dow Chemical Co., The
Midland, Michigan
Uranium and Titanium

E. I. duPont deNemours & Co., Inc.
Wilmington, Delaware
Plutonium and Titanium

Electro Metallurgical Co. (Div. Union Carbide Corp.)
New York, N. Y.
Titanium

Fansteel Metallurgical Corp.
North Chicago, Illinois
Tantalum and Niobium

Foote Mineral Co.
Philadelphia, Pa.
Zirconium and Lithium

Freeport Sulphur Co.
New York, N. Y.
Nickel

General Electric Co.
Schenectady, N. Y.
Uranium and Plutonium

Goodyear Atomic Corp. (Div. The Goodyear Tire and Rubber Co.)
Akron, Ohio
Uranium

W. R. Grace Co.
New York, N. Y.
Rare Earths

Harshaw Chemical Co., The
Cleveland, Ohio
Uranium

Hooker Electrochemical Co.
Niagara Falls, N. Y.
Boron

Horizons Inc.
Cleveland, Ohio
Thorium

International Minerals & Chemical Corp.
Chicago, Illinois
Uranium

International Nickel Co.
New York, N. Y.
Nickel

Kaiser Aluminum & Chemical Corp.
Oakland, California
Aluminum

Kawecki Chemical Co.
Boyertown, Pa.
Tantalum and Niobium

Kennametal Inc.
Latrobe, Pa.
Niobium

Kerr-McGee Oil Industries, Inc.
Oklahoma City, Okla.
Uranium

Knowles Associates
New York, N. Y.
Uranium; Nuclear Metals

Lindsay Chemical Co.
West Chicago, Illinois
Thorium and Rare Earths

Lithium Corp. of America
Minneapolis, Minn.
Lithium

Arthur D. Little, Inc.
Cambridge, Mass.
Uranium

Los Alamos Scientific Laboratory, USAEC
(University of California, contractor)
Los Alamos, New Mexico
Uranium and Plutonium

Mallinckrodt Chemical Works
St. Louis, Mo.
Uranium

Maywood Chemical Works
Maywood, N. J.
Thorium and Lithium

Metal Hydrides, Inc.
Beverly, Mass.
Uranium and Zirconium

Mines Development, Inc.
Edgemont, S. D.
Uranium

National Research Corp.
Cambridge, Mass.
Titanium

National Lead Co.
New York, N. Y.
Uranium, Zirconium, Nickel

Nuclear Metals, Inc.
Cambridge, Mass.
Beryllium

Oak Ridge Laboratories (of Union Carbide Nuclear Co.)
Oak Ridge, Tenn.
Uranium and Zirconium

Olin Mathieson Chemical Corp.
New York, N. Y.
Boron

Permutit Co., The
New York, N. Y.
Uranium

Phillips Petroleum Co.
Bartlesville, Okla.
Uranium

Quebec Iron and Titanium Corp.
New York, N. Y.
Titanium

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Aluminum

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Philadelphia, Pa.
Uranium

Rust Engineering Co.
Pittsburgh, Pa.
Uranium; Nuclear Metals

Sherritt-Gordon Mines, Ltd.
Toronto, Canada
Nickel

Singmaster and Breyer
New York, N. Y.
Uranium; Nuclear Metals

Stanford Research Institute
Menlo Park, California
Uranium and Boron

Stauffer Chemical Co.
New York, N. Y.
Boron and Titanium

Stearns-Roger Manufacturing Co.
Denver, Colorado
Uranium; Nuclear Metals

Titanium Metals Co. of America
New York, N. Y.
Titanium

Union Carbide Nuclear Co.
New York, N. Y.
Uranium

United States Borax and Chemical Corp.
Los Angeles, Calif.
Boron

U. S. Bureau of Mines
Washington, D. C.
Uranium, Titanium, Zirconium

U. S. Industrial Chemicals Co., Div. National Distillers & Chemical Corp.
New York, N. Y.
Zirconium and Titanium

U. S. Phosphoric Products Div., Tennessee Corp.
New York, N. Y.
Uranium

Uranium Reduction Co.
Moab, Utah
Uranium

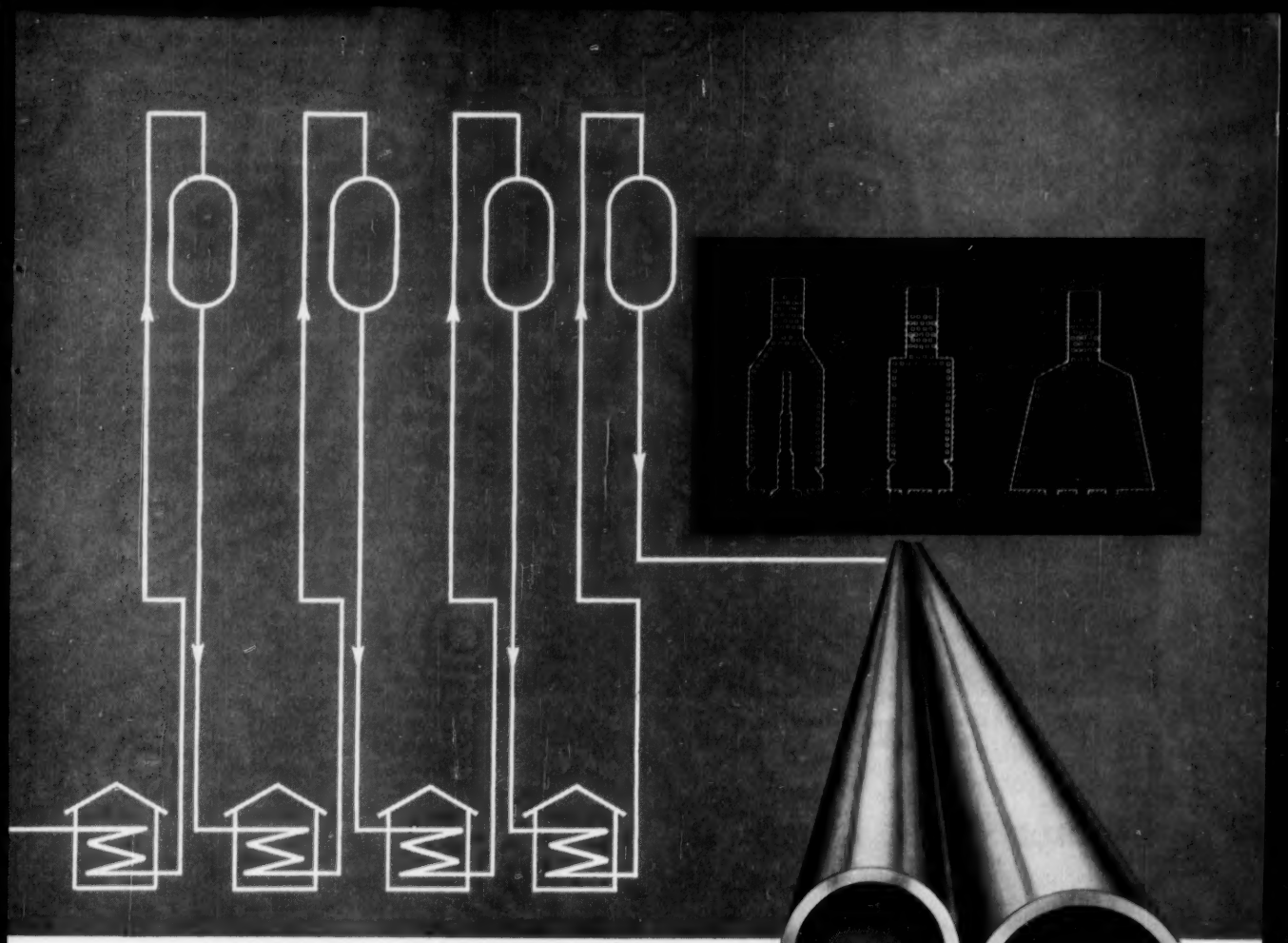
Vanadium Corp. of America
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Uranium

Virginia-Carolina Chemical Co.
Richmond, Va.
Uranium

Vitro Corp. of America
New York, N. Y.
Uranium

Wah Chang Corp.
New York, N. Y.
Zirconium, Hafnium, Niobium

Westinghouse Electric Corp.
Pittsburgh, Pa.
Uranium and Zirconium



HOW MANY PROBLEMS IN THIS PICTURE?

Some layouts present a multiplicity of engineering, purchasing, warehousing and financing problems. Conceivably, (1) Return bends have to be designed for a perfect fit on their heater tubes, (2) Both tubing and fittings must meet the same exacting customer standards, (3) Simultaneous delivery must be made to guarantee erection schedules, and (4) Money tied up in material in process at any one time must be kept to a minimum.

In such a situation, it's best to depend upon Mr. Tubes for coordinated delivery of perfectly matched tubing and fittings.

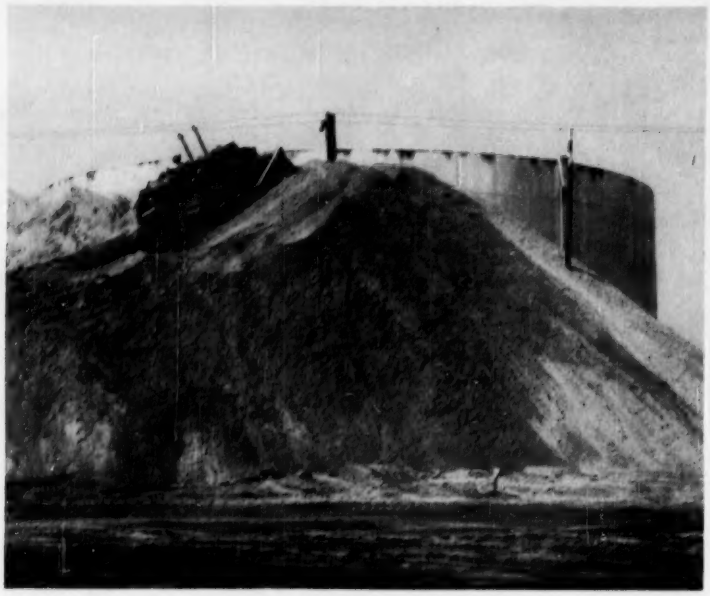
Think of your own requirements in terms of the right tube for the job, tubing (or alloy pipe) and welding fittings and forged steel flanges as components of an integrated system—and you'll make B&W's Mr. Tubes a member of your team. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W

TUBULAR PRODUCTS DIVISION

TA-6085-PP

Seamless and welded tubular products, seamless welding fittings and forged steel flanges in carbon, alloy and stainless steels



MAN-MADE sand dunes at Esso refinery provide . . .

Firmer Tank Foundations

Esso Standard Oil Co. has a special reason for piling up these mountains of sand at its Bayonne, N. J., refinery. It's a new answer to the old problem of "shifty" subsoil beneath proposed tank sites, which causes settling of the tank foundations.

Known as "preloading," method consists of piling heavy mounds of sand or other material, such as chrome ore, over the proposed site, compressing the soft organic soil below. Esso believes this method will not only prevent later settling of tank foundations but will also cost less than former construction methods.

▶**Sand Piles Vs. Wooden Pilings**—Usual procedure in cases where soft soil is encountered is to drive wooden pilings and to rest the tank foundations on these piles. But Esso believes, after extensive studies of soil conditions at its Lower Hook tank field, that the more economical preloading method will prove just as effective. Used previously mainly in highway construction, this marks the first time Esso has used preloading in tank building.

Foundations for three 150,000-gal. tanks are getting the preloading treatment. Mounds are being piled on top of settlement platforms, 6-ft.-dia. steel plates. Candy-striped poles 20 ft. high attached to these platforms are used to measure the amount of settling. The mound pictured above, when completed, was 25 ft. high and contained 25,000 cu. yd. of sand.

Construction on the tanks is slated to start next April after the mounds have been in place ten months.

New Process May Bring Lower-Cost Titanium

Titanium, the metal that's finding increasing use in corrosion control and in high-temperature applications, may be in for further price reductions. Armour Research Foundation has come up with a new process for producing titanium tetrachloride, an intermediate in the manufacture of titanium metal.

Main advantage of the new process is its use of ilmenite, a cheap, iron-bearing titanium ore. Most titanium processes now depend on expensive, imported, titanium-rich rutile ore.

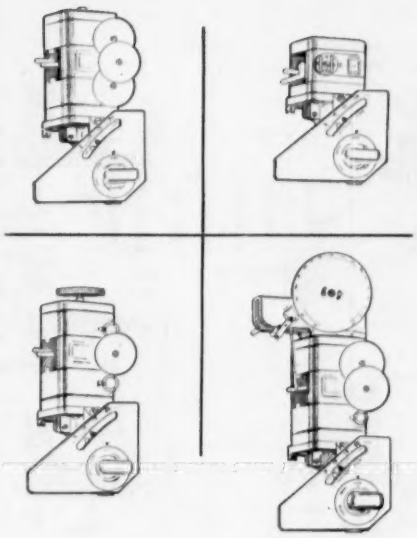
Heart of the process is low-temperature, controlled crystallization. Ilmenite is dissolved in sulfuric acid and the solution chilled to 23 F. Iron content crystallizes out as ferrous sulfate and is filtered off. Then, after saturating the titanium solution at 32 F. with HCl gas and adding solid potassium chloride, potassium chlorotitanate precipitates out. $TiCl_4$ is produced by decomposing the chlorotitanate at 752 F., with regeneration of the KCl.

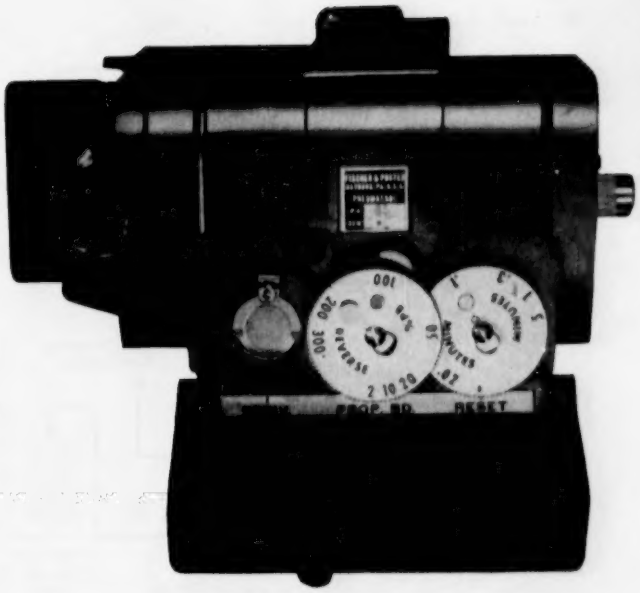
▶**Process Pro and Con**—Frederick Schossberger, originator of the process, claims two additional advantages over present $TiCl_4$ producing methods:

- Lower process temperatures can be used—752 F. compared with 1,472 for direct chlorination of titanium ores.
- Higher purity of $TiCl_4$—no contaminating iron or vanadium chlorides.

Another possible advantage of the new process might result from a tie-in with a titanium dioxide pigment plant. Since the conventional titanium pigment process involves digesting ilmenite in sulfuric acid and crystallizing out the iron, the Armour process could simply bleed off a stream of titanium sulfate solution for making tetrachloride. The rest would continue on its usual way to TiO_2 pigment. Or the new process could be tied in with a plant where waste HCl gas was available.

Process is still in the laboratory stage; ARF is seeking industrial sponsorship for further development. Several industrial spokesmen, however, are lukewarm about the new process. They feel that potential savings in raw materials were not significant in the over-all titanium metal picture. And the main advantage of Armour's process—substitution of ilmenite for rutile—becomes less significant as titanium ore deposits in North America are discovered and exploited.





NOW . . . the P-4 controller is better than ever!

Back from a thorough redesign, the P-4 has more to offer than ever before. All the advantages proved in years of actual use have been retained . . . and more have been added. Chief among the improvements resulting from this complete re-evaluation are:

- Even *lower* steady state air consumption—and increased amplifying relay capacity
- Improved linearity plus increased gain in the error detection network
- Greater independence from dirty air supply
- Easily accessible external alignment adjustments
- Improved frequency response characteristics
- Greater flexibility—new "Universal" design provides 2-50% proportional action, on-off controller action, 2-100% differential gap action—in *one controller!*

Brilliant instrument design has permitted all these improvements with no change in bellows construction or motion balance principle of operation. In-case models still feature completely integrated *in-the-case* accessories, free of troublesome links or complex external members. And they can still be mounted left or right with equal ease, permitting two to a single case if desired. Of course, a complete line of plug-in models for use with miniature instruments is still available.

If you'd like to investigate the renewed P-4B controller first hand, call in the Fischer & Porter field engineer serving you . . . or write for new Catalog 53P-4000 to Fischer & Porter Co., 207 County Line Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

PERFORMANCE SPECIFICATIONS • SERIES 53P—P-4B CONTROLLERS

Output pressure—*3 to 15 or 3 to 18 psig*

Set point and process pressures for field or plug-in models—*3 to 15 psig*

Index tracking at any output pressure—*within 1% of scale (Reset controller)*

Temperature limit—*225 F*

Supply pressure—*17 to 22 psig*

Zero frequency gain (Reset controller)—*approximately 300*

Derivative gain—*approximately 12*

Field mounting manifold cut-off valve—*air to open*

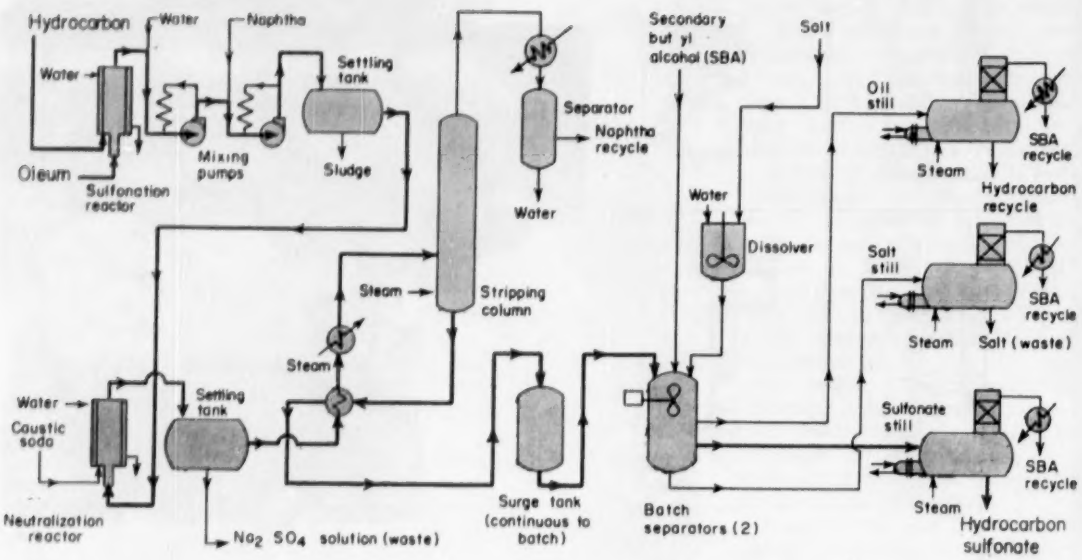
Steady state air consumption—*0.08 scfm*

	In Case Controllers	Plug-In And Field Mounted
On-off	53PR 4101	
"Universal" controller; 2-50% proportional, on-off, and 2-100% differential gap	53PR 4241	53PN 4240
Proportional only	53PR 4301	53PN 4300
Proportional plus fast derivative	53PR 4411	53PN 4410
Proportional plus slow derivative	53PR 4421	53PN 4420
Proportional plus fast reset	53PR 4511	53PN 4510
Proportional plus slow reset	53PR 4521	53PN 4520
Proportional plus fast derivative plus fast reset	53PR 4611	53PN 4610
Proportional plus fast derivative plus slow reset	53PR 4631	53PN 4630
Proportional plus slow derivative plus slow reset	53PR 4621	53PN 4620
Ratio—Proportional plus fast reset	53PP 4511	

FP

FISCHER & PORTER CO.

Complete Process Instrumentation



Hydrocarbon Sulfonation Goes Continuous

Three new plants, making lube oil additives and synthetic detergents, mark commercial debut of continuous sulfonation processes.

Continuous sulfonation of hydrocarbons, having tantalized chemical and petrochemical processors for the past few years in the form of patents, pilot and semi-commercial plants, has now stepped into the commercial community on an impressive scale. In swift succession this year, three major sulfonation plants, harnessing two new continuous processes, swung on stream.

Surpass Petrochemicals Co.'s $750,000 installation at Scarborough, Ont., engineered by the Girdler Co. (Louisville), uses Girdler's favorite processing tool, the Votator scraped-surface reactor. Brought to full capacity this June, the new plant turns out over 7 million lb./yr. of oil-soluble sodium sulfonates destined chiefly for lube oil additives, chemical intermediates and corrosion inhibitors.

Other two plants follow a flowsheet developed by Chemithon Corp. (Seattle) that derives its continuity from a centrifugal pump-heat exchanger combination serving as reactor. Bunge Corp. of Sao Paulo, Brazil, in operation since February, produces 5 million lb./yr. of sulfonates for lube-oil-additive markets. Kao Soap Co. of Tokyo, on stream in June, manufactures 6 million lb./yr. of sulfonates, primarily for synthetic detergents.

▶**Problem: Mix and Cool**—Key to success of these continuous flowsheets hinges on how they handle problems posed by the sulfonation step itself. Two immiscible streams — sulfonating agent (e.g., oleum) and hydrocarbon (e.g., petroleum crude)—must be intimately contacted to get economical yields. And high exothermic heat of reaction, that tends to spoil product quality while the two streams are in contact, must be removed rapidly. Both functions are conventionally accomplished in oversize, heftily jacketed batch kettles.

Girdler's process at Surpass calls on a Votator heat exchanger-reactor to do the job. Internal blades provide vigorous mixing and promote rapid heat transfer through reactor wall. Cooling jacket around unit simultaneously carries away reaction heat.

Chemithon's route uses a modified centrifugal pump to contact hydrocarbon with oleum. It provides rapid mixing and thus minimizes contact time between the two streams while at high temperature. Then subsequent heat exchangers swiftly cool the reactants.

▶**New Plant Trend?**—Some industry observers predict that these three plants signal a growing trend away from conventional batch sulfonation kettles —at least among new installations. Girdler, pointing to Surpass, cites these convincing reasons why:

Continuous process slashes sulfonation reaction time from a matter of hours (10-15 hr.) to a matter of minutes (1-5

Many Thanks

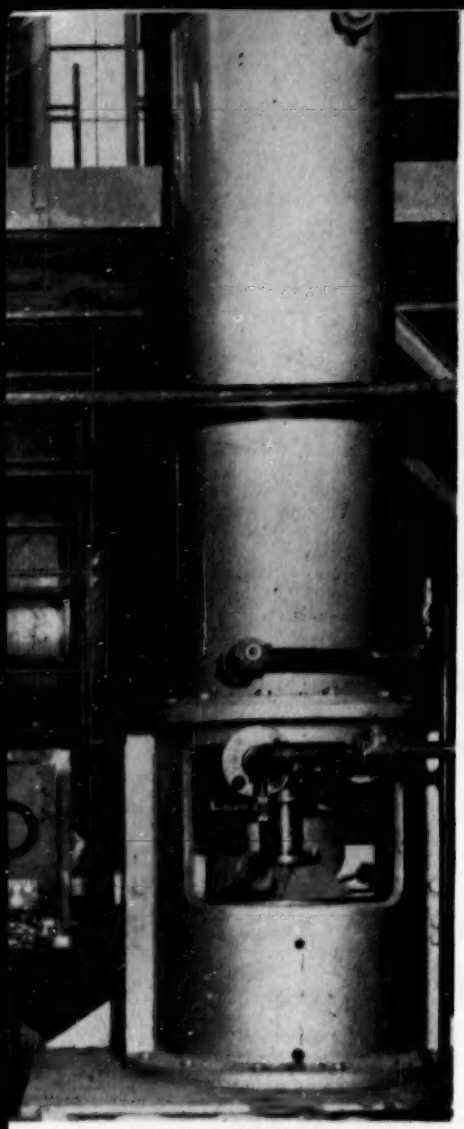
and a bit of an apology...

Right from the first announcement the wide interest shown in the extra benefits available to processors from the new high capacity Sharples Series P-3000 Super-D-Canter has far exceeded our most optimistic estimates. For this we are indeed grateful.

Because of the large response for test runs, the Sharples Testing Laboratories are doing their very best to keep up with the load as well as to schedule additional runs at the earliest possible dates. Even though these dates may now be a little later than originally anticipated, we assure you that, when scheduled, you can depend on them. We hope you'll get in touch with us soon to make arrangements for a run on your material in this latest high efficiency, continuous solids discharge centrifuge for dewatering and solids classifications.

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SCRAPED-SURFACE reactors feature Girdler's sulfonation process.

min.). This allows a high throughput rate and a compact installation to pare plant's initial investment cost. For example, Girdler estimates that floor space at Surpass for its Votator reactor is 75% less than that required by a comparable-capacity batch sulfonator.

Too, short sulfonation time beats risk of product discoloration from exposure to high temperature. And continuous operation is a natural for instrumentation and automation. This means labor savings (only two operators per shift are needed at Surpass) and a close control of operating variables that insures top product quality and uniformity.

Far and away, the most persuasive attraction of continuous sulfonation, observers agree, is capital cost savings. For this reason, trend predictions are apt to be limited to new plants. Most operators of batch sulfonators have long paid off their initial investment, thus can't be expected to scrap their plants on this score.

But there are plenty of new plants a-coming to keep continuous process advocates optimistic. For example, synthetic detergent sales are booming—3 billion lb. in 1956, pretty nearly 3.2 billion lb. expected for this year—and this means new facilities will be sprouting to keep production up to demand.

▶ **How Surpass Works**—Proportioning pumps deliver 2,850 lb./hr. petroleum crude and 1,000 lb./hr. 20% oleum to the Votator sulfonation reactor. This unit is a vertically placed, stainless steel, water-jacketed cylinder about 12 ft. tall and 10 in. I.D. A hollow agitator shaft, fitted with scraper blades, runs through the cylinder.

Oil enters the annular space; oleum feeds through the shaft. Oleum squirts into the reaction chamber through a series of check valves along the shaft. Reaction takes place at 100 F. and is essentially complete in just under 1 min.

Crude sour oil, primarily sulfonic acid, leaves the top of the reactor and mixes with naphtha (2,850 lb./hr.) and water (55 lb./hr.) in the pipeline via proportioning pumps. Stream then goes to a 4,000-gal., mild steel separation tank, where undesirable sulfonates, sulfuric acid and other sludge are drained off. Residence time in this tank is 4 hr.

Next step is neutralization of sulfonic acids with 18% NaOH solution in a second, identical Votator heat exchanger-reactor. Caustic solution feeds to the annular space, while sulfonic acid stream enters unit via the hollow agitator shaft. From neutralization, stream settles for 4 hr. in another 4,000-gal. separation tank to remove sodium sulfate. Then naphtha and water are split out of the stream as recycle overhead in a 20-ft.-high by 2-ft.-dia. atmospheric distillation column.

▶ **Batch Finishing** — At this point flowsheet switches to a batch basis. Main stream from bottom of naphtha splitter passes through a 3,000-gal. surge tank and enters one of two parallel-hooked, 4,000-gal. clarifying tanks, fitted with side-entering agitators. While one tank is being loaded, the other is on stream.

A 71% secondary butyl alcohol stream and a 5% NaCl solution are mixed with sulfonates for 1 hr. Then during a 3-4-hr. settling period, the materials separate into three layers.

Bottom layer contains inorganic salts and low-molecular-weight organic impurities. It's pumped to a batch still for alcohol recovery. Second layer contains the product sodium sulfonates. Another batch distillation operation splits it into a product stream for market and an alcohol stream to recycle. Top layer contains unreacted oil that is recovered for reuse, along with the butyl alcohol, in a third batch still.

A Surpass spokesman reports that this plant can and will, in the very near future, be adapted to the manufacture of lithium, calcium, barium and ammonium sulfonates of petroleum hydrocarbons.

Soviets Plan Big Atomic Reactor Power Station

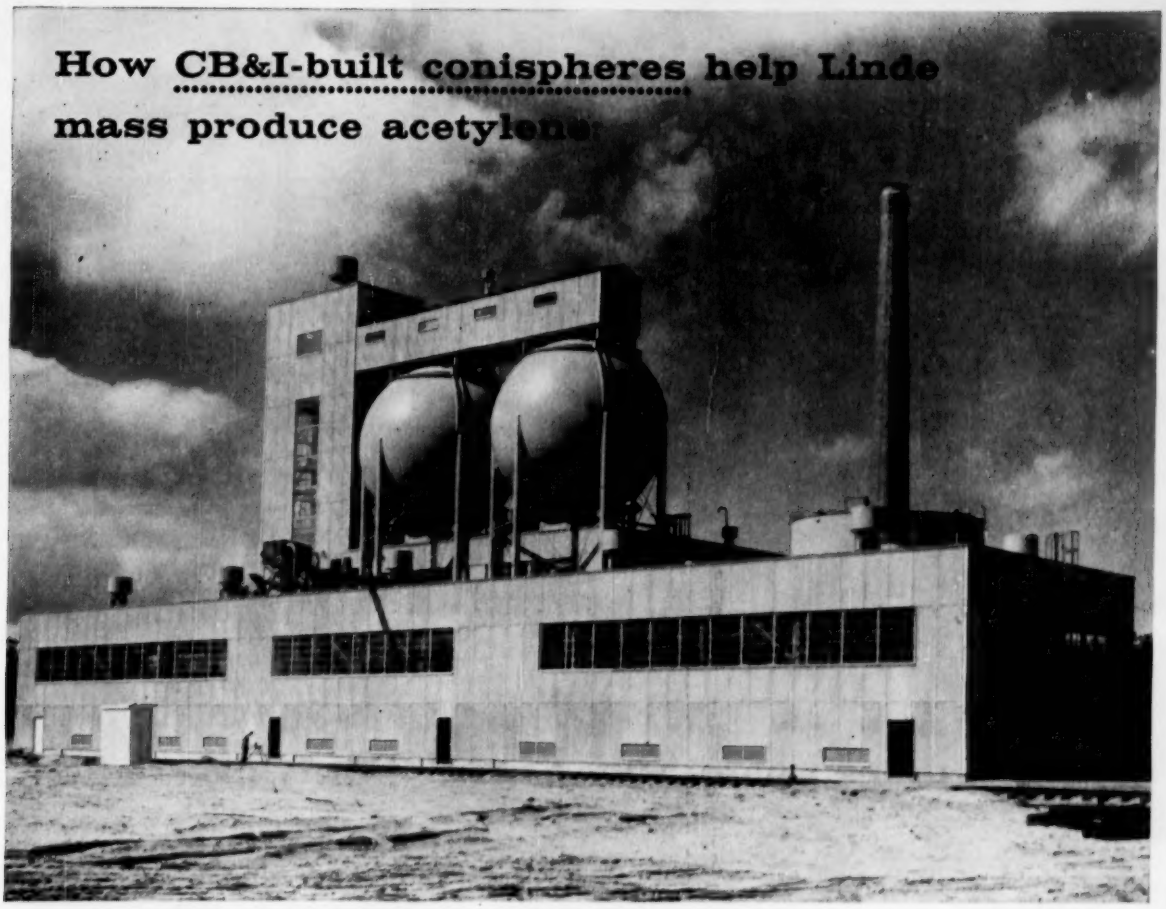
Soviet Union plans to build a 420,000-kw. atomic power plant, according to a recent item in bulletin of the Soviet embassy in Germany.

By comparison, power output of Britain's Calder Hall station is 92,000 kw.; largest station now planned in U. S., scheduled for 1962, is 200,000 kw.

Soviet station will have two pressurized-water reactors, will require 34 tons of natural and 46 tons of enriched (1.4% U-235) uranium dioxide.

Each reactor will power three turbogenerators totaling 210,000 kw. of electrical output. Water, acting as moderator and heat-transfer medium, will be heated to about 527 F. at 100 atm. Reactor is to be powered by a system of zirconium tubes containing nuclear fuel.

How CB&I-built conispheres help Linde mass produce acetylene



Neoprene plant gets constant flow of raw material via direct pipeline.

The two 30-foot diameter CB&I-built conispheres (Hortonspheres® with conical bottom outlets) shown above serve as a vital link in Linde Company's new mass acetylene production plant at Montague, Michigan.

The 500-ton capacity structures are designed to keep a ready and free-flowing supply of calcium carbide available for generation into acetylene—one of the components for manufacturing *Neoprene*.

Through a unique "stockroom" arrangement Linde is able to maintain a steady flow of raw material to a nearby neoprene plant—via pipeline.

Standard or special steel plate structures such as these are a specialty and an "art" with CB&I. Whether you're building new or expanding—the extensive fabrication and erection facilities offered by CB&I enable us to work to your most *rigid* specifications. Write our nearest office for new literature on CB&I Field Erection Services.

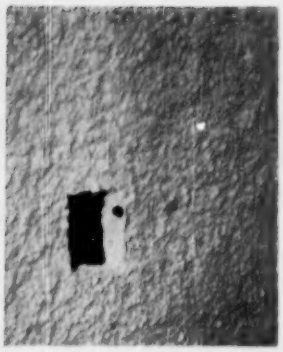
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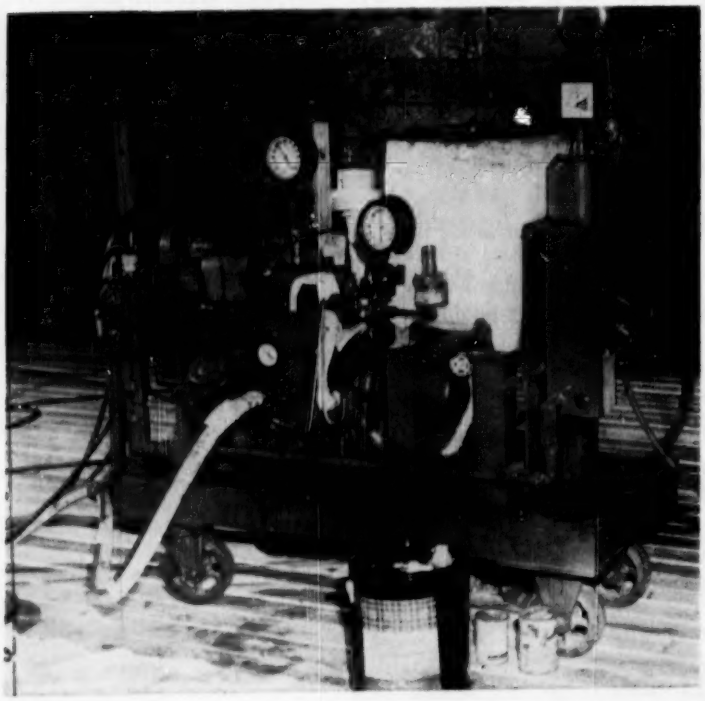




1-in. blanket from ¼-in. film.

Sprayed-On Foam Slices Insulation Cost

Newest use for the versatile polyurethanes has already chalked up commercial success after overcoming complex development problems.



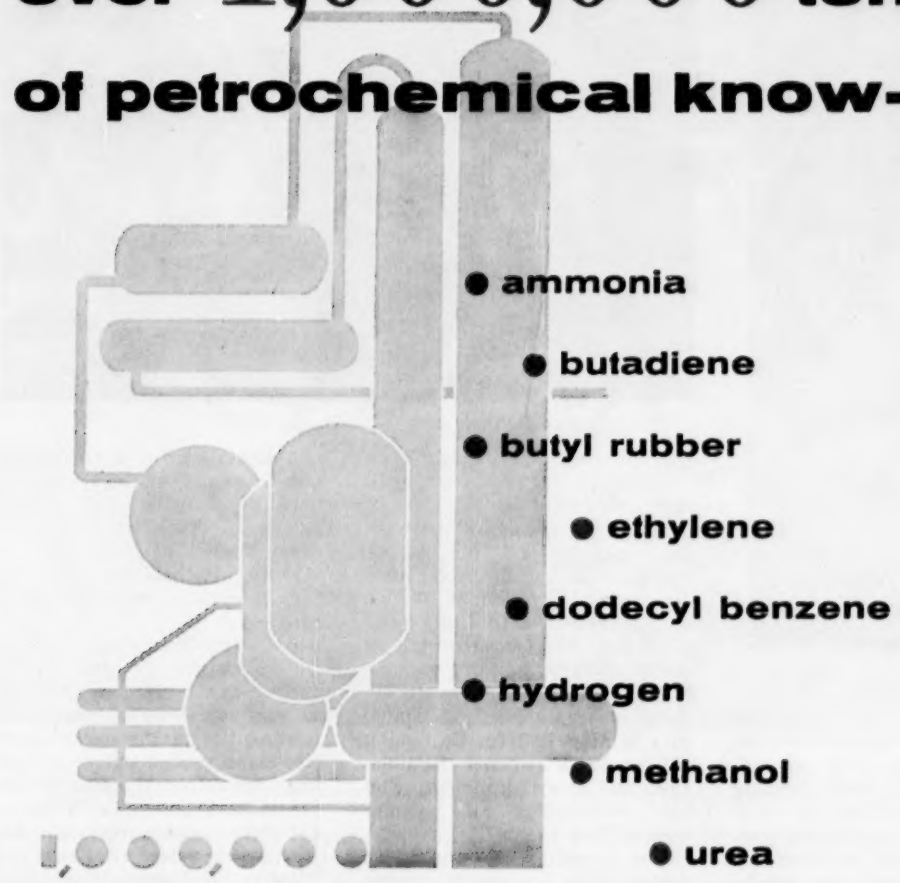
INSULATION of a chemical process vessel in 16 man-hours instead of 192—this kind of saving is calculated to excite any plant engineer.

It's done by spraying the vessel surface with a urethane polymer which expands and sets to a resilient or rigid insulating foam immediately upon application. It requires special equipment and techniques which have recently reached an advanced stage of development and which are now becoming available for widespread usage.

The job just cited was done by Solvents and Plastics Co., St. Louis, for a large chemical plant in the St. Louis area. The vessel was 6 ft., 10 in. dia. and 8 ft. high. A two-man crew sprayed on a 1-in.-thick foam blanket in 8 hr.; concurrently, an identical tank being insulated by another contractor, using magnesia block, took a four-man crew six days.

▶ **No Simple Task** — Urethane

over 1,000,000 tons/yr of petrochemical know-how



- ammonia
- butadiene
- butyl rubber
- ethylene
- dodecyl benzene
- hydrogen
- methanol
- urea

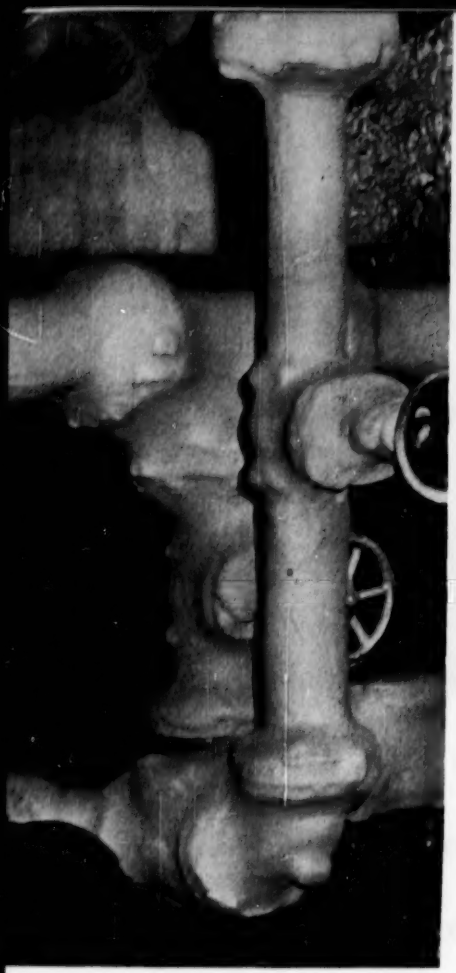
MORE than twenty FW process installations totalling more than a million tons capacity per year are now in operation or under construction.

This specialized know-how—encompassing design, engineering, fabrication and erection all over the world—gives Foster Wheeler a firm foundation for serving the requirements of all producers planning process facilities in the expanding petrochemical industry.

Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.

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foams are formed by mixing a catalyst with a liquid prepolymer just before application (see *Chem. Eng.*, Sept. 1955, pp. 112-114). Compared with pouring into a mold, spraying the catalyzed polymer is no simple task. It requires special polymer formulations as well as special equipment. The polymer must foam and set fast enough to get desired thickness (as much as 2 in.) without sag or fall-away from vertical or overhead surfaces. Yet if it sets too fast upon mixing inside the spray gun, it would clog the gun.

Spray equipment must provide for accurate proportioning of the prepolymer and catalyst, plus thorough mixing of the two. Development of satisfactory spray equipment has been an especially tough problem.

As a maker of isocyanates, essential ingredients in urethane foams, Du Pont has been particularly eager to demonstrate successful application of sprayed-on foam insulation. However, two attempts made last year in Du Pont plants were far from satisfactory. It was not until this July that Du Pont got a trouble-free, economical sprayed-on insulation job. This was on an icehouse at the company's Deepwater (N. J.) plant. It took only 6 man-days to hand-spray the walls and beamed ceiling of the 49x25x9-ft. building.

► **Who's Who**—This recent Du Pont job was applied by Minnesota Mining & Mfg. Co., using 3M-developed polymer formulations and spray equipment. (3M has tradenamed its polymer mixes "Scotchfoam.")

The company has worked on design of this spray equipment for over two years. It has come up with a package unit which sells for $8,950—including gun, proportioning unit and hose. Because of the technical aspects of these materials and their application, 3M provides the services of an applications engineer for initial applications and for the training of customer personnel.

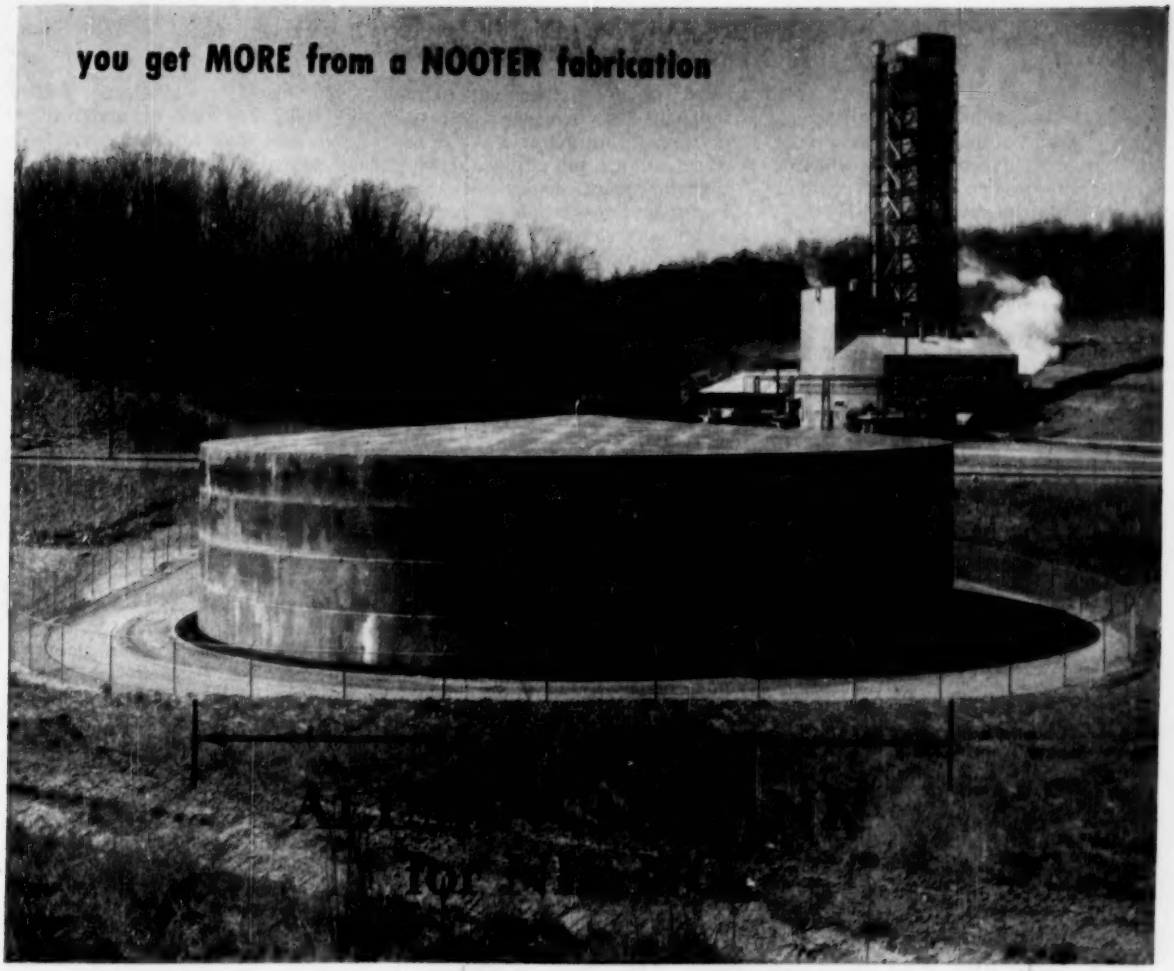
Other firms engaged in formulation of ingredients for sprayed-on foams include Isocyanate Products (Wilmington, Del.) and American Latex Products Corp. (Hawthorne, Calif.). ALPCO's Stafoam formulations are applied with a De Vilbiss spray system. Isocyanate Products' are applied via equipment developed by Sprayfoam, Inc. (St. Louis), using a De Vilbiss gun. Isocyanate Products, in conjunction with De Vilbiss, claims to have been first to demonstrate the feasibility of spraying urethane foams with a fully integrated, external-mixing spray gun.

Although Sprayfoam uses a De Vilbiss gun, it uses its own system for feeding ingredients to the gun. Big difference in feeding lies in the use of positive-displacement pumping (3M and Sprayfoam) rather than pressurized pots (De Vilbiss). 3M claims an accuracy of 0.5% in pumping rates. (Solvents and Plastics Co. licenses Sprayfoam equipment, gets its ingredients also through Sprayfoam.)

► **Putting It On**—Foam can be applied in any thickness from $\frac{1}{4}$ to 2 in. and in any density from 1.5 to 20 lb./cu. ft. For a 1-in.-thick foam, the thickness of liquid coating (before expansion) is about $\frac{1}{16}$ to $\frac{1}{8}$ in. thick.

Thermal conductivity at the low end of the bulk-density range is about 0.20 Btu./(hr.)(sq. ft.)(deg. F.)(in.). Isocyanate Products suggests temperature limitation of 212 F. for continuous service, 250 F. for intermittent use.

3M recommends that the foam be sealed after application to protect it from water vapor. On its icehouse job Du Pont applied a sprayed-on vapor barrier



Here's another big Nooter job, an aluminum tank for storing 83% ammonium nitrate solution. It was built for Mississippi River Chemical Company. This squat, but mighty reservoir has a height of 23 feet, a girth of over 314 feet. Walls and interior structure are aluminum, which was specified for its corrosion resistance to this fertilizer raw material. And Nooter fabricating experience assured flaw-free welds throughout.

But any other material, or any other storage tank design would have been field erected just as perfectly, finally inspected just as carefully and completed on time.

For your next big job, talk to Nooter. You'll find Nooter's quality and dependable schedules your best equipment investment.

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of Hypalon synthetic rubber (chlorosulfonated polyethylene).

For "ordinary" spraying (not in difficult spots or overhead), 3M figures an application rate of 12 sq. ft./min. of 1-in.-thick foam.

Liquid urethane polymers normally contain some free isocyanate compounds, such as toluene diisocyanate. Isocyanate vapors can be irritating and can produce allergic reactions. Du Pont points out, with its usual emphasis on health and safety, that workers doing the spraying should wear pressure-fed air masks and that other personnel should be cleared from the immediate area while spraying is in progress. After the foam has set, there is no hazard.

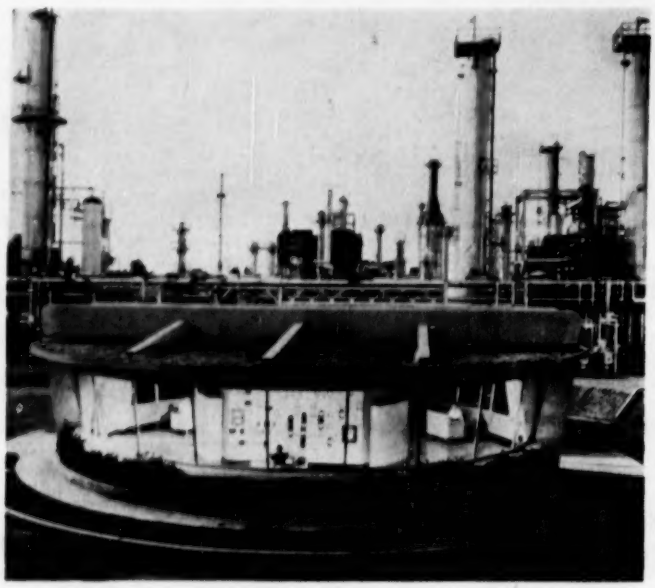
▶ **Economic Factors**—Right now the raw materials for urethane foam are more expensive, pound for pound, than other competitive insulating materials. It's in labor savings and reduced downtime of plant equipment that sprayed-on insulation claims its cost advantages.

In addition to the 16-man-hr. process vessel job, Solvents and Plastics Co. cites the insulation of a 300-ton air-conditioning unit which was done this May. Foam thickness was 2 in. on the unit itself, 1 in. on piping, valves and flanges. It took three days with a two-man crew.

Alkylation Aids Race For Octane Ratings

Standard Oil Co. (Ind.) will expand facilities at its Mandan, N. D., refinery. Addition of a 1,630-bbl./day alkylation unit will play key role in manufacture of high-octane gasoline components.

Based on Phillips Petroleum Co.'s HF process, unit will use propylene-butylene feed stock from the Mandan refinery and isobutane stock piped in from Tioga, N. D., 160 mi. away. September 1958 is target completion date.



Circular Control Room Serves Three Refinery Units

Here's a novel twist in control-room design at McMurrey Refining Co.'s Tyler, Tex., refinery. Built by Blaw-Knox for McMurrey, control house's triangularly arranged panelboards each face the unit it serves. Panelboard seen in photo is for alkylation unit; others are for catalytic reforming and crude units. Located inside triangle formed by panelboards are all service facilities for control house.

New Nickel Process Gets Greater Yield

Second round of laboratory test work started in July on a promising new electrolytic process to improve recovery and boost output at the pioneering government-owned nickel plant, Nicaro, Cuba. Fat prize for success will be an additional pound of nickel for every 3-4 lb. now being recovered.

Present operations recover only 75-80% of the nickel in the ore. The remainder, together with virtually all the iron and chromium and most of the cobalt, has been wasted with the tailings. Big hurdle has been to win the residual nickel content without including more than 1% cobalt.

Examination of several electrolyte systems, completed recently by the Bureau of Mines, Albany, Ore., disclosed that eventual clearing of this hurdle may lie in use of a nickel sulfate-boric acid system. The new round of tests will probe operating variables of this process.

As with present process, ore is roasted to reduce nickel and cobalt. Roast is leached with an ammoniacal solution, and the values are precipitated as carbonates.

Then with the new technique, the mixed carbonate precipitate is leached with nickel sulfate-boric acid solution. Differential solubility enriches the solution predominantly with nickel values. Electrolysis of this liquor at controlled current density completes the separation by depositing nickel that contains only 0.4% cobalt.

Separation of nickel from cobalt by solvent extraction may offer another solution to this problem. Bureau of Mines' sta-

Now! ISOPHTHALIC based paints and plastics are leading the way to superior products

Important new raw material of many uses

With Isophthalic now in plentiful supply from Oronite Chemical Company's 50 million pound per year capacity plant, paint manufacturers can produce new and better surface coatings that have superior flexibility, hardness, impact resistance, color and gloss retention. Plastics (Polyamides, Polyesters-amides, Polyesters) employing Isophthalic based resins open the door to new and better products at attractive cost.

Paint

With Isophthalic, longer oil length resins (up to 93%) can be built that dry faster to tougher films, and the longer oil length results in significant cost savings.

Baking Finishes

Isophthalic baking finishes are harder, have better gloss retention, are more resistant to alkali, water and mineral spirits. Less amino resin is required resulting in further cost savings.

Exterior House Paints

Formulation of Isophthalic alkyd oils with pentaerythritol and low rosin content tall oil fatty acids produces house paints with superior drying properties than those made from soybean oil. The harder drying films of Isophthalic paints have better resistance to mold growth, film checking and cracking than conventional linseed oil paints. Exterior house paints made with Isophthalic have superior weathering characteristics, excellent non-yellowing properties.

Interior Gloss Enamels and Flats

Odorless enamels and flats of excellent quality can be produced more economically with Isophthalic resins. Low rosin content tall oil acids used in longer (70-75%) oil length Isophthalic resins provides a low cost vehicle for interior enamels that are unusually flexible, have excellent gloss retention properties.

Industrial Finishes

Industrial finishes that dry faster, adhere better to metal and that retain their gloss longer are now possible with Oronite* Isophthalic. Such coatings are especially suitable as exterior structural steel paints, equipment finishes, enamel undercoatings and industrial primers.

Plastics

The superior properties of polyesters made with Isophthalic are maintained even at high styrene dilutions. With Isophthalic high viscosities can be adjusted by further dilution with styrene without loss in properties. The excellent performance of Isophthalic at greater styrene dilutions offers new economies in the cost of materials for resin solutions.

Plasticizers made with Isophthalic have greater thermal and color stability, higher boiling points, better resistance to oxidation, greater plasticizing efficiency and less toxicity and no odor.

Reinforced plastics, of unsaturated polyester type that withstand higher temperatures, that can resist more flexing, that have higher impact strength and that have better adhesion to glass are now possible with Oronite Isophthalic. When Isophthalic based plastics are reinforced with glass, these properties carry over into the laminates resulting in superior resistance to water erosion and pressure.

Let Oronite prove to you how Isophthalic can benefit your products. Oronite field representatives will be glad to demonstrate to you the many advantages of Isophthalic

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tion at Salt Lake City is vigorously exploring this approach. Continuous pilot-plant runs are scheduled for early trials on completion of two minor preliminary investigations.

Coal-Tar Vitamins From Koppers Plant

Arroyo, W. Va., is the site of a new Koppers Co. niacin (nicotinic acid) plant producing 500,000 lb./yr. of the B-complex vitamin. Raw material for Koppers' niacin is quinoline, a coal-tar product brought to Arroyo from Koppers' Follansbee, W. Va., plant.

Koppers' niacin process involes continuous sulfonation of quinoline with sulfuric acid and oxidation of the resulting quinoline-8-sulfonic acid with nitric acid. Purification of the niacin is a Koppers secret.

Merck & Co. and Allied Chemical & Dye's Barrett Div. are nation's two other major niacin producers. Merck uses 2-methyl 5-ethyl pyridine as raw material while Barrett, like Koppers, uses coal-tar quinoline.

Side by side with Koppers' niacin plant is a coal-tar semiworks plant. With two 50-tray distillation columns and a series of crystallizers, Koppers hopes to find economical means of producing marketable high-boiling (500-700 F.) coal-tar components. Phenanthrene, anthracene and carbazole will receive particular attention.

Possibility for the Arroyo plant is production of niacinamide, a niacin derivative, and 8-hydroxy-quinoline, a mildewproofing chemical. Both quinoline-based chemicals have been pilot-produced and could be made commercially with additions to the niacin unit.

Coal, Oxygen, Steam Make Gas Substitute

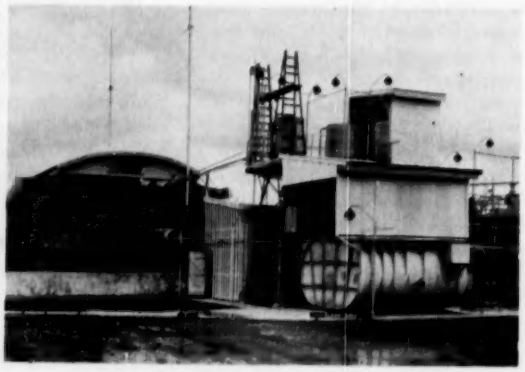
Institute of Gas Technology, Chicago, has perfected one step of a two-step process for converting low-grade coal into 800-900-Btu./cu. ft. fuel gas. IGT process entails first gasifying the coal and then upgrading the resulting gas by methanation. Gas utility industry is interested in developing an inexpensive substitute for natural gas against the day when this country's gas reserves are exhausted.

IGT's contribution is a process that is independent of quality or ash content of the coal. Other gas-from-coal processes have been restricted to certain grades of coal. IGT gasification process has successfully run on a pilot-plant scale; gas is now being used in methanation studies to boost heat content up to the desired level.

Coarse granules of coal are suspended in a stream of compressed air and steam, impregnating pores of the coal with gas. Suspension is directed through a nozzle into a cyclonizer; internal pressure partially ruptures the granules. After a second cyclonizer, attrition and partial combustion have reduced most of the particles to 200 mesh. Compressed oxygen is added, and stream passes to a reacting chamber where 90-95% of carbon content is gasified. Pressure in reactor is 5-7.5 atm.; temperature is high enough to change residual ash to a molten slag.

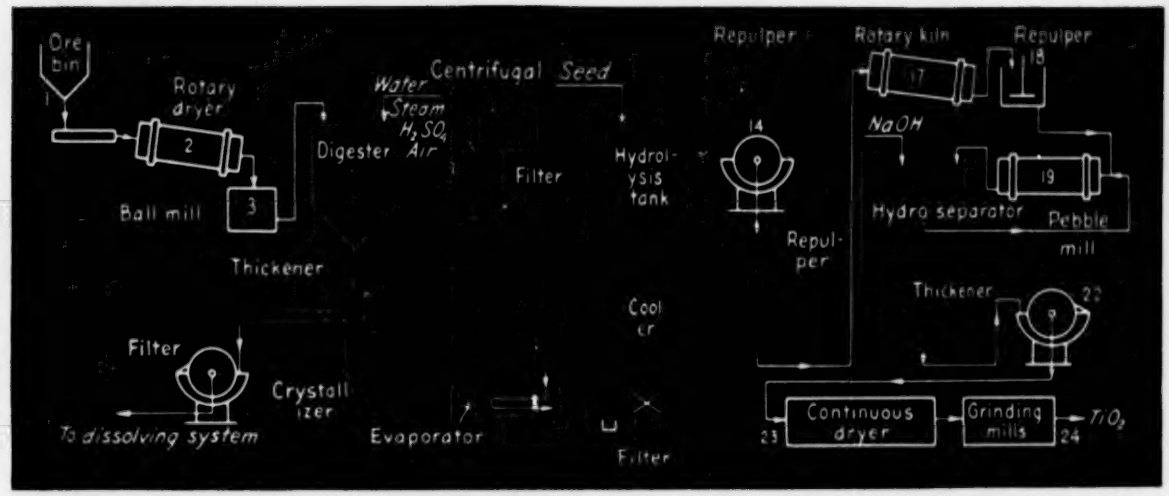
Product gas is 70-80% CO and hydrogen; CO/H_2 ratio is around 1. Water-gas shift of a portion of the synthesis gas increases CO/H_2 ratio to around 3, rendering it more suitable for methanation.





Australian Nitroglycerine Manufacture Goes Continuous

Nitroglycerine is being produced on a continuous basis by Imperial Chemical Industries of Australia and New Zealand Ltd. Photo at left shows interior of the nitration building at the Deer Park plant just outside of Melbourne. Stainless steel process equipment is operated by remote control from the operator's desk in the center. Large cylindrical vessel at right is the nitrator, then follows an acid separator and three washing vessels. Photo at right shows outside of building. Service tanks are at center and right foreground.



HOW *lead is used to control corrosion in Titanium Dioxide Production Equipment*

TiO_2 is not corrosive. But H_2SO_4 is a real metal-eater . . . *first* on the attacking line in the production of TiO_2.

First on the defensive line, however, is *lead*, dependability itself when it comes to combating many corrosive chemicals.

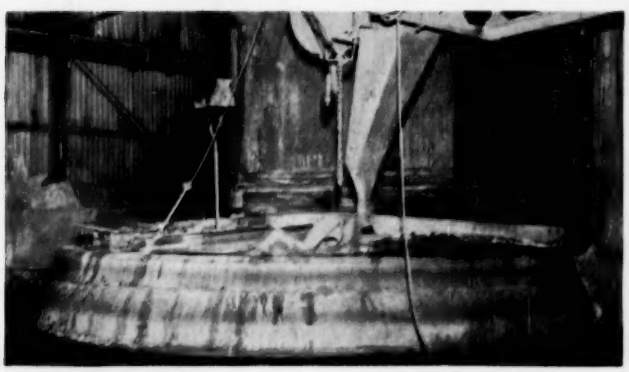
Lead reacts on contact with H_2SO_4 and other "corrosives" to form an insoluble, impermeable film. This film adheres to the metal surface . . . stopping or slowing down further reaction or attack.

Starting with digesters, where ilmenite ore is treated with sulphuric acid, *lead* is a steady defender . . . as lining for vessels and tanks, valves and pumps, in heating and cooling coils, in centrifugals and filters. It is used in combination with steel, concrete, wood or brick in many of the steps in the manufacture of TiO_2.

And bear this fact in mind: the use of *lead* cuts down-time. *Lead* lends itself to prompt, low-cost repairs. In case of leak or lesion, the affected area may be fixed quickly, with minimum loss of production. And . . .

. . . when you think of Lead . . .

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National Lead's long experience in bringing *lead* and steel together . . . in acid-handling lines, in complex, massive process, storage and shipping vessels . . . is at your service. When *lead* and steel are bonded together in this equipment, the union is stronger than *lead's* tensile strength. Cracking of the lining, due to vibration, pressure and rapid cyclic temperature changes, is held to a minimum. Creep is virtually eliminated.

Perhaps *lead* can save you money. Contact National Lead Company, Lead Lined Products, 111 Broadway, New York 6, N. Y., for information.

Recover Pulping Chemicals This New Way

First big installation of Western Precipitation's new process will recover chemicals while avoiding troubles from scale and corrosion.

SULFITE pulpers appear to have gained a major new weapon in their continuing struggle to choke off the torrent of pollutants discharging from their mills.

Now under construction at Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis., is the first commercial-scale installation of Western Precipitation Corp.'s "soda ash recovery process," a process that converts pulping waste to heat and reusable chemicals without the scaling and corrosion problems that usually plague sulfite liquor recovery.

Scheduled for startup early next year, Consolidated's $500,000 experimental plant will process for reuse all collectible solids from its semichemical pulp operations. At present, these solids discharge into the Wisconsin River. If plant performs as expected, Consolidated will expand it to process all its spent sulfite liquor.

▶ **Works on Any Liquor**—Design of the new plant is based on mill-scale pilot runs conducted with existing equipment at Nekoosa-Edwards' kraft mill, Nekoosa, Wis. According to Western Precipitation's reports on these and earlier trials, the soda ash recovery process is more versatile for treating spent liquor than any other method.

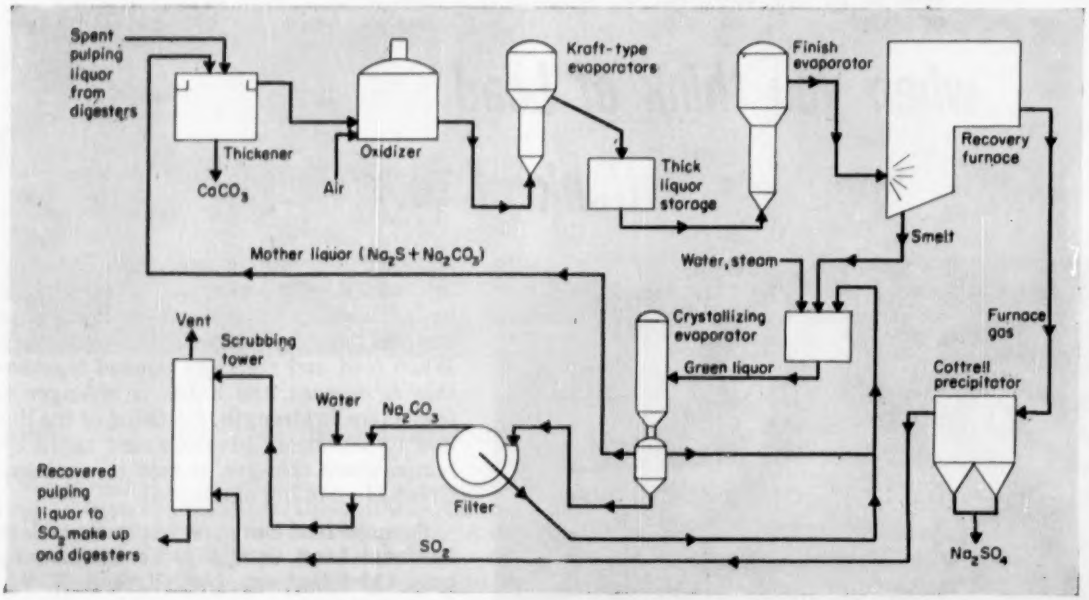
It works equally well on waste liquors from kraft, neutral sulfite semichemical or sodium acid sulfite pulping, either singly or in combination. That means it can be used by mills where both semichemical and kraft, semichemical and sulfite, or sulfite and kraft processes are operating.

Process converts semichemical or sulfite spent liquor to easily processed, noncorrosive kraft-type liquor that can be handled in regular kraft-mill recovery equipment. There is no need for equipment specially designed for corrosion resistance or scale handling.

As a safety bonus, process offers freedom from the danger of hydrogen sulfide fumes. This lethal gas, common to other sulfite recovery processes, is found only within the recovery furnace of the WP process.

▶ **Careful Analysis**—Aside from the tough engineering problems that have faced pulpers in their

Recycle stream knocks down lime . . . **. . . ties up corrosive sulfite ions and toxic H_2S . . .** **. . . permits trouble-free evaporation and burning . . .** **. . . to produce steam, Na_2S, Na_2CO_3, SO_2.**



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tussle with pollution, there has been an uphill struggle to fit recovery into the economic balance of mill operation. With careful engineering, the soda-ash recovery process can become a favorable operation costwise.

According to Robert Q. Boyer, principal chemical engineer and key figure in Western Precipitation's development, the value of steam produced by the recovery system becomes a determining factor in justifying a soda ash recovery system.

Recovery furnace and boiler are actually a combination high-pressure steam generator and chemical process unit. Capitalization should therefore be divided. As a steam producer, the unit is equivalent in value to a fuel-fired boiler having an equal steaming rate. Only the cost in excess of this value is a capital charge against chemical recovery.

Key to economic operation is the water load to the evaporator and the related heat economy of the evaporation and burning system. Only by careful attention to preparation of the cooking liquor, operation of the digester and collection of the liquor, can recovery be economical.

▶ **Built Around Recycle** — Incoming spent liquor is rendered noncorrosive and nonscaling by reacting it with a Na_2S-Na_2CO_3 stream recycling from farther down the recovery line (*see flowsheet*). After concentration by evaporation, the spent liquor is burned in a recovery furnace to produce steam, a Na_2S-Na_2CO_3 smelt and SO_2 gas.

Sodium carbonate recrystallized from the smelt is dissolved and reacted with SO_2 in the recovery furnace flue gas to make sodium bisulfite liquor for the pulp digesters. Sulfide-carbonate mother liquor remaining after crystallization of sodium carbonate is the recycle liquor which reacts with the incoming spent liquor stream.

▶ **Calcium Removed First** — Spent sodium-base pulping liquor from the digester blow pit contains lime picked up from the wood during cooking. Sodium carbonate in the recycle liquor reacts with this lime to form calcium carbonate, which is removed in a thickener. Fine pulp fibers present in neutral sulfite liquor also settle out here.

▶ **Sulfide Ties Up Sulfite**—Freed of calcium, liquor is then blown with air to raise the sulfide sulfur to zero-state oxidation. In this state, the sulfur reacts rapidly with available tetravalent sulfur in the lignosulfonates to form thiosulfates and polythionates. This basic procedure, discovered by Linn Bradley and Boyer, renders the sulfite sulfur noncorrosive and prevents liberation of hydrogen sulfide during concentration of the liquor prior to burning. Characteristics of the liquor now resemble kraft black liquor.

Fixed liquor from the blowing operation goes to multiple-effect evaporators for concentration to 45% solids. At this concentration it can be stored, if necessary, prior to entering the final steps in the recovery cycle. At higher concentrations the liquor will polymerize on standing.

Before passing into the recovery furnace, the liquor is boosted to 65% solids with a forced-circulation evaporator.

▶ **Mole for Mole** — What happens in the recovery furnace controls the amount of sulfur in the recycle liquor, preventing it from building up prohibitively. Because of the mechanics of charring and burning, the smelt will contain 50% sulfidity (an equimolar mixture of sodium sulfide and sodium carbonate). This is true even when the ratio of sulfur to sodium is quite high in the firing liquor. Excess sulfur goes off as SO_2.

Ratio of sodium to sulfur is fixed by the time charring is completed. During charring, sodium sulfide apparently converts mostly to sodium carbonate. Any sodium sulfate in the liquor goes through the charring stage unchanged. All the organic sulfur compounds are partitioned mole for mole to Na_2CO_3 and Na_2SO_4, releasing excess sulfur into the furnace gas.

During the smelting step, Na_2SO_4 is reduced to Na_2S. Residue carbon burns off and the Na_2S-Na_2CO_3 mixture melts.

▶ **Final Steps** — Furnace smelt is dissolved, making green liquor feed for the crystallizing evaporator, where sodium carbonate crystals form. Filtered and washed crystals are repulped, and the solution is pumped to a scrubbing tower, where it contacts SO_2-laden flue gas out of the Cottrell precipitator. The resulting sodium bisulfite liquor passes through a raw acid tower to pick up makeup SO_2 that boosts it to full strength for digestion of chips to pulp.

Super-Refrigerator To Aid Missile Research

Research near temperatures of absolute zero will be aided by a new super-refrigerator just installed at the Palo Alto research labs of the Lockheed Missile Systems Div., Sunnyvale, Calif. Known as a cryostat, unit will produce 1,000 liters/mo. liquid helium at −452 F. This liquid helium will be used by Lockheed scientists to investigate low-temperature phenomena, such as superconductivity, hoping for new discoveries in electronics, materials and space operation.

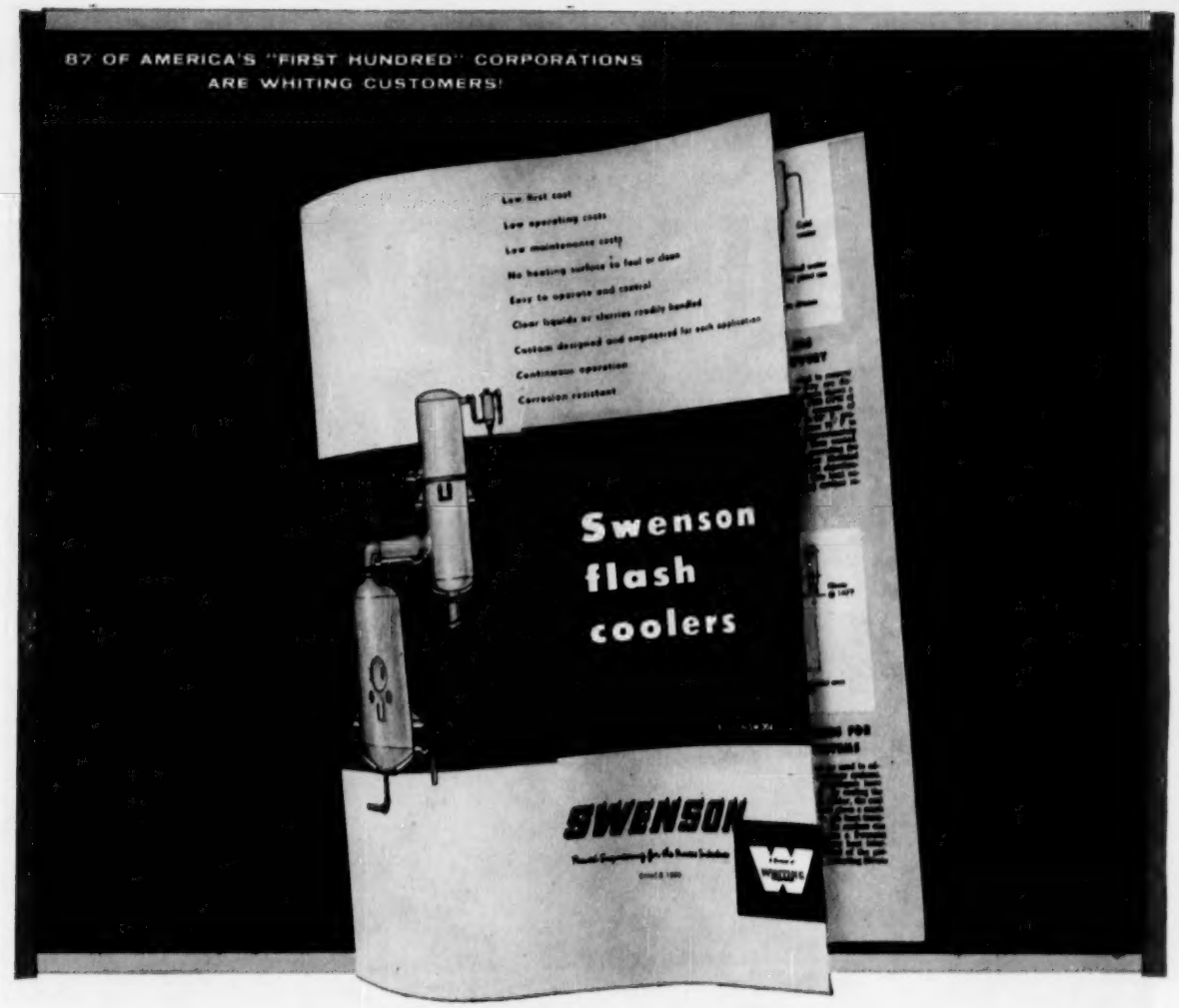
News Briefs

Sulfur, sulfuric acid: Stauffer Chemical Co. will double capacity of sulfur recovery unit at Baytown, Tex., also plans a 400-ton/day sulfuric acid regeneration unit at Hammond, Ind., which will process oil refinery sludge acids.

Uranium: Globe Mining Co. and Union Carbide Nuclear Corp. are planning a $7-million, 1,000-ton/day uranium processing mill in the Gas Hills area of Wyoming.

Petrochemicals: Union Carbide Corp. slates a major plant in Putnam County, W. Va., to produce such basic organics as ethylene, propylene and ethanol. New facilities will add an initial 150 million lb./yr. to Carbide's ethylene oxide capacity.

Pipeline: Soviet Union reports first 50-kilometer section of trans-Siberian pipeline has been commissioned between Tuimazy and Irkutsk.



Here are the facts on peak performance, low cost flash coolers

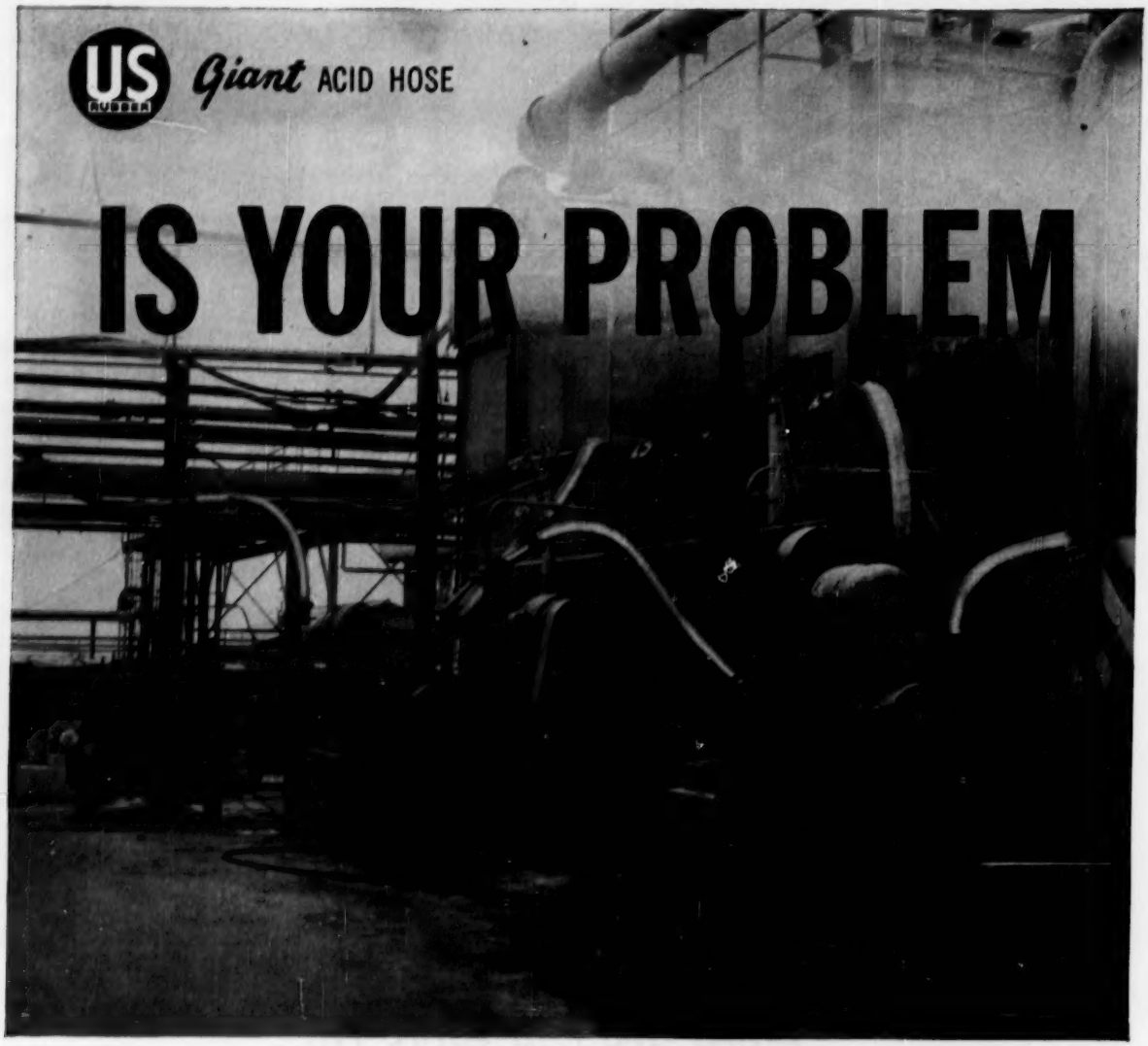
Send for this new booklet—you'll see how the Swenson Flash Cooler can be custom engineered to your exact requirements. Various construction materials, flash nozzles and other adaptations are discussed. Sections of the booklet are devoted to single stage vs. multiple stage cooling and to flash coolers for heat recovery and heat interchange. Send for this valuable information today! Request Bulletin SW-204, "Swenson Flash Coolers." *Swenson Evaporator Company, 15669 Lathrop Avenue, Harvey, Illinois.*

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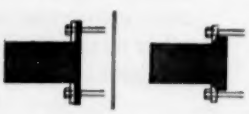
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acetic acid
aluminum: chloride, sulphate
alums
ammonia
ammonium: chloride, hydroxide, nitrate, phosphate (mono-, bi-, tri-basic), sulphate
amyl alcohol
aniline hydrochloride
arsenic acid
barium: chloride, hydroxide, sulphide
boric acid
butyl alcohol
calcium: chloride, hydroxide, hypochlorite
casein
chlorine dry (wet on application)
citric acid
copper: chloride, sulphate
dilute chromic acid
dilute nitric acid
ethyl chloride
ethylene glycol
ferric: acid, chloride sulphate
fluoboric acid
fluosilicic acid
formalin
formic acid
gallic acid
gelatine
glucose
glue
glycerine
glycerol
hydrobromic acid
hydrofluoric acid
hydrofluosilicic acid
hydrogen sulphide water
lime slurry
liquors: beet sugar, caliche, cane sugar, green sulphate
magnesium: chloride, hydroxide, sulphate
malic acid
methyl alcohol
mulic acid
nickel: chloride, sulphate
phosphoric acid
picric acid (aqueous solution)
plating solutions
potassium: chloride, cyanide, hydroxide, sulphate
propyl alcohol
soaps
sodium: bicarbonate, bisulphate, carbonate, chloride, cyanide, fluosulphate, hydroxide, metaphosphate, phosphate (mono-, bi-, tri-basic), silicate, sulphate, sulphide
stannic chloride
sulphur trioxide (dry)
sulphuric acid
sulphurous acid
tannic acid
tartaric acid
triethanolamine
vinegar
water, acid mine: containing oxidizing salts, no oxidizing salts
zinc: chloride, sulphate

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U. S. RUBBER *Giant* ® ACID HOSE	✓	✓	✓	✓	✓
METAL ALLOY PIPE					
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LEAD PIPE					

corrosion resistance — specially compounded rubber tube gives outstanding service life, carrying a wide range of chemical solutions (see list on opposite page).

unrestricted flow — hose gently bends and curves, requiring no flow-restricting fittings as with rigid pipe.

ease of installation — because of the flexibility of the hose, it bends readily around obstructions; hose sections are connected with ease.

economy — U. S. Giant Acid Hose, because of its easy maneuverability, can be led more directly. This saves time, space and length of line.

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U. S. Giant Acid Hose—both for discharge and for suction and discharge—are specially constructed to conduct highly corrosive solutions. Both types of hose excel in meeting the severe conditions that are encountered in chemical plants, food plants, metal refineries, smelter operation, and other such places using highly concentrated chemicals.

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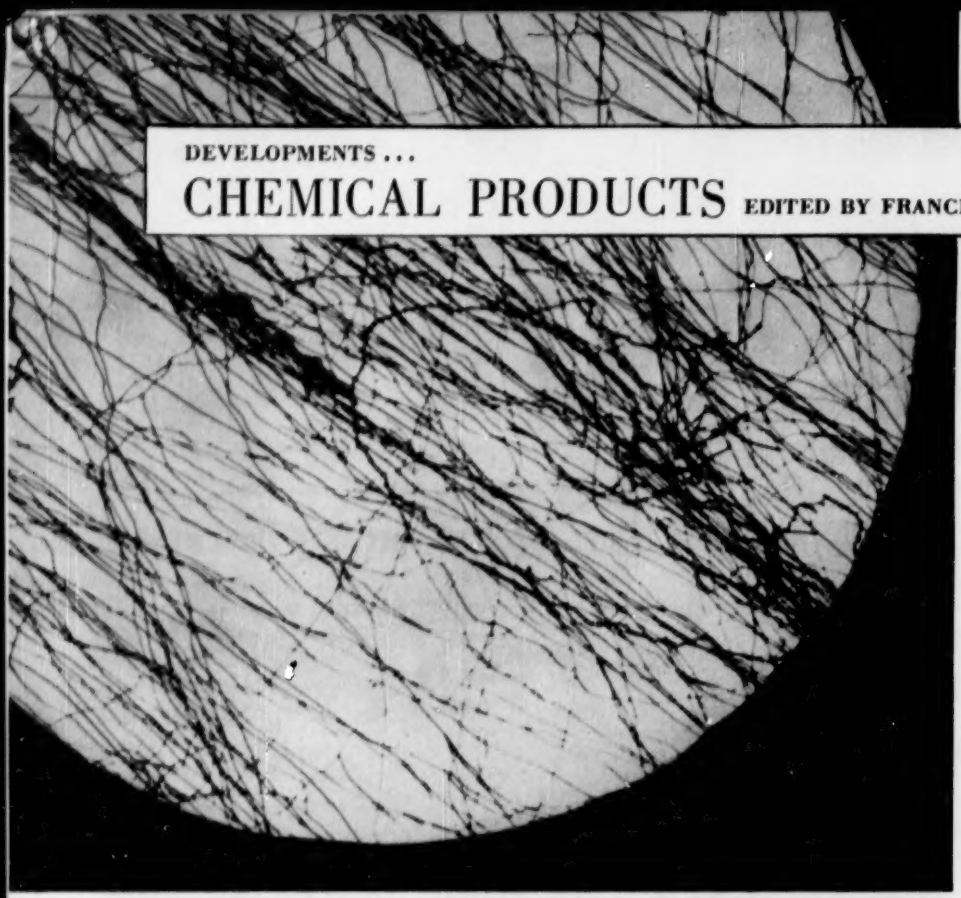
For new or replacement chemical lines, check the advantages of U. S. Giant Acid Hose over any other type line. This hose—with expert engineering assistance—is available at the 28 "U. S." District Sales Offices, at selected distributors, or write us at Rockefeller Center, N. Y. 20, N. Y.

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TRUE CARBON FIBERS from hydrocarbon gas at Pittsburgh Coke & Chemical.

Carbon Fibers Reach the Market

Carbon fibers are shifting from laboratory curiosity to pilot plant item. From two different raw materials and companies, they are coming to market.

Pittsburgh Coke & Chemical has just started up a semiworks unit at Neville Island, Pa., to produce carbon fibers. In 1954 company produced what it believes was the first example of a truly fibrous form of carbon formed in good yield by dissociation of a hydrocarbon gas.

Now Atomic Laboratories, Inc., Berkeley, Calif., reports 1,000-lb./mo. production of a dense fibrous form of pure carbon from a different raw material source. Here fibers are made by carbonizing rayon into pure carbon by proper amount of heating.

Atomic Laboratories describes its product as a dense fibrous form of pure carbon that can be activated or used in its inert form. Available in diameters of 5 to 50 microns, fibers are reportedly clean, strong and flexible—first available fibers boasting such features.

The California company expects its product to find use wherever granular carbon is now used. It promises to overcome two prime objections to granular carbon: high pressure drop in granular beds and difficulty of removal of the fine carbon particles. Some possible uses are in filtration, semiconductors, air conditioning units in nuclear plants.

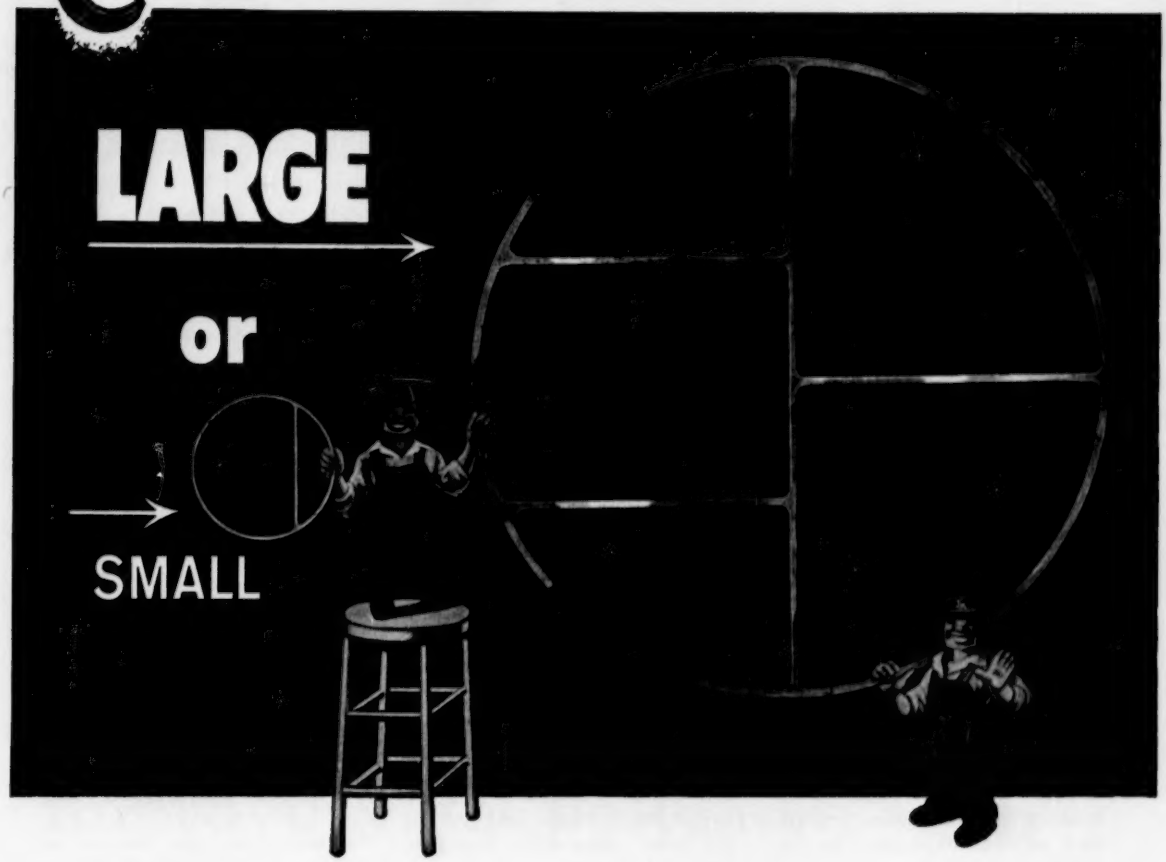
Right now price is $10/lb. but it is expected to drop to $2/lb. when larger scale operations begin. Though considerably more expensive in first cost than granular material, the new product is expected to have longer service life. — **Atomic Laboratories, Inc., 3086 Claremont Ave., Berkeley, Calif. 172A**

Pittsburgh Coke & Chemical believes that specific speculation about applications for its carbon fiber would be premature. New facilities aim at making enough available for extensive field testing, and for limited sales development purposes.

At present, Pittsburgh Coke & Chemical Co. puts emphasis on the interesting implications of its manufacturing technique. The "whisker" form in which it produces the carbon fibers resembles the form in which other researchers have obtained small samples of other very pure elements.

Dilute hydrocarbon gases, particularly methane, when py-

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And because they're *precision-made*, you'll find these better gaskets provide the effective sealing and longer life that make them actually cost less in the long run. Each gasket is carefully constructed in every detail to assure accuracy of fit . . . to provide ample lap widths and uniform rib widths . . . and to prevent trouble-making wrinkles or cracks on the corners.

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Another real fur moves over for synthetic.180A
Titanium di- and trichloride in quantity..180B
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New adsorbent, silica in skeleton form...180E
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rolized at temperatures of 1,150 to 1,450 C. give masses of long single filaments; or short filaments appearing as a flexible mat or felt of interlaced fibers. The form obtained depends on temperature, the contour of the gas stream, the gas velocity over the collecting surface and other variables. Usual diameter of the fiber is 0.5 to 1.0 microns; upper range, 4.0 microns; lower range, 0.1 microns.

The original experiments leading to carbon fiber production were made during an investigation of the high temperature reactions of coke oven gas. It was found that coke oven gas, or a mixture of one volume CH_4 and two volumes of H_2, and containing some H_2S, was best suited for pyrolysis for carbon fiber production. U. S. Patent 2,796,331 has been granted the company covering the process.

PC&C found that carbon fibers would grow from many surfaces such as silica, alundum and nichrome. Gas passing over alundum balls gives a mass of carbon tufts or "whiskers" on the balls. Thus a process could be visualized where alundum balls pass in and out of the pyrolysis zone and fibrous carbon separated by water jets or air blowing after a certain amount of heat recovery.

Extensive studies have been made of the physical properties of the Pittsburgh fibers. Product application studies will be initiated at various laboratories when material is available from the new unit.—**Pittsburgh Coke & Chemical Co., Grant Bldg., Pittsburgh 19, Pa. 172B**

Rubber Accelerator

Provides tighter cure for both natural and synthetic latex.

A new liquid ultra accelerator, called Vulcacure NS, for use in both natural and synthetic latex compounds has just been introduced.

Producing both a high modulus and high tensile strength in latex rubber films, it is completely water soluble and can be used successfully over a wide range of curing temperatures, from 70 to 300 F.

Of liquid dithiocarbamate type, the new accelerator's low viscosity insures uniform distribution throughout the latex and provides a tighter cure (tack-free) than possible heretofore with most similar compounds.

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Manufacturer also reports excellent aging characteristics.

It is packaged in non-returnable containers and is available by the drum or in 5 to 50 gal. quantities to satisfy individual requirements.—**Alco Oil & Chemical Corp., Philadelphia 34, Pa. 174A**

Lithium Compounds

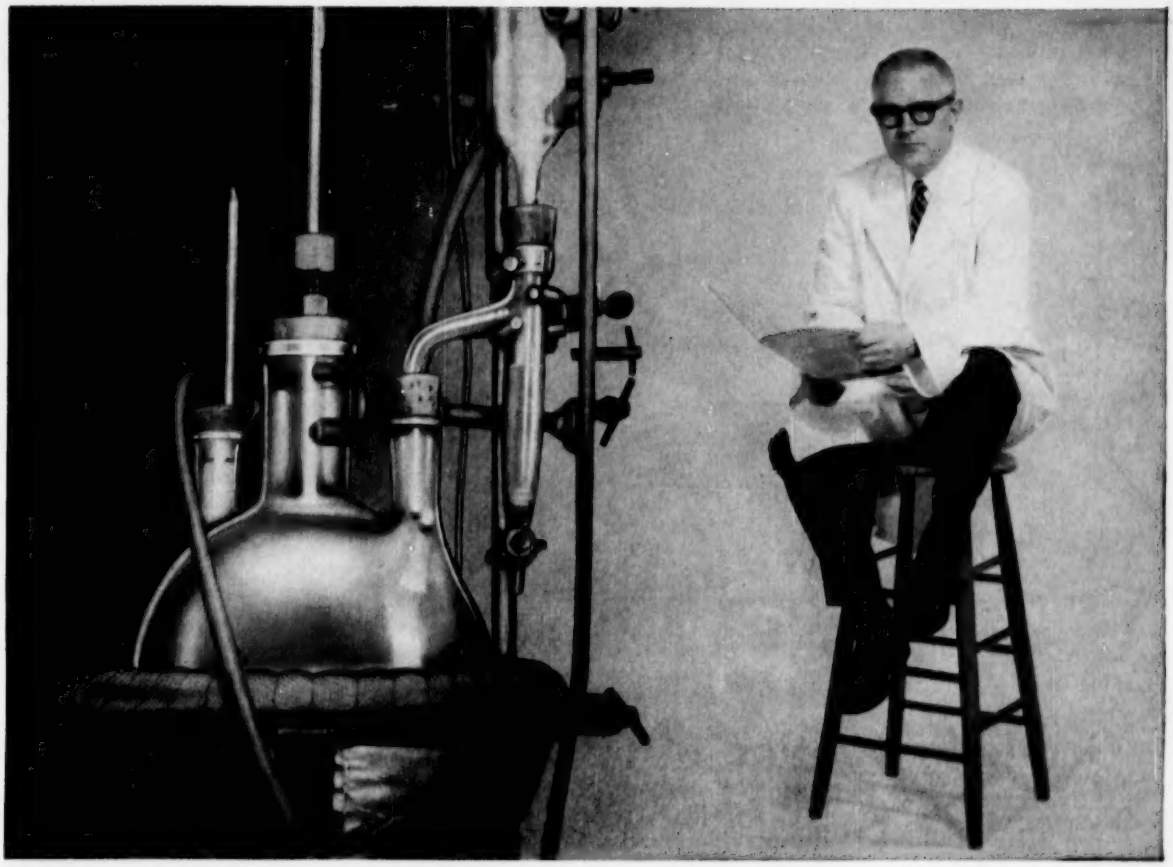
To supply the oxygen for use of high energy fuels.

Production has begun of lithium perchlorate and lithium nitrate for use in high energy fuels applications such as rockets and missiles.

The two chemicals are both oxidants to provide oxygen for solid propellants. As oxidants, they also may be used in flares and other pyrotechnics.

On a weight basis both of the lithium compounds have a high oxygen content—about 60% in lithium perchlorate and nearly 70% in lithium nitrate. It is this property which makes them of interest for propellants.

Company already manufactures two oxidants, ammonium perchlorate and potassium perchlorate at its Henderson, Nev., electrochemicals plant. It is the only domestic producer of ammonium perchlorate which is being widely used as the oxidizer in rockets and missiles by the Air Force, Navy, and Army.—**American Potash & Chemical Corp., 3030 West 6th St., Los Angeles, Calif. 174B**



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SPECIALTY RUBBERS—Copolymerize butyl acrylate with acrylonitrile to get hot oil and ozone resistant rubbers useful for tough gasketing applications.

ADHESIVES—Homopolymers of 2-ethylhexyl acrylate are useful as adhesives and bonding agents.

TEXTILE FINISHES—Copolymers of vinyl acetate with higher acrylates are suggested for finishing cottons.

LUBRICATING OILS—Investigate copolymers of higher acrylates for viscosity index improvers and pour point depressants.

Applications don't stop here! A roundup of known and potential uses for the higher acrylates and ethyl acrylate, butyl acrylate and 2-ethylhexyl acrylate are described in—ACRYLIC ESTERS (F-7434)—For a copy write Union Carbide Chemicals Company, Department H, Room 328, 30 East 42nd Street, New York 17, New York.

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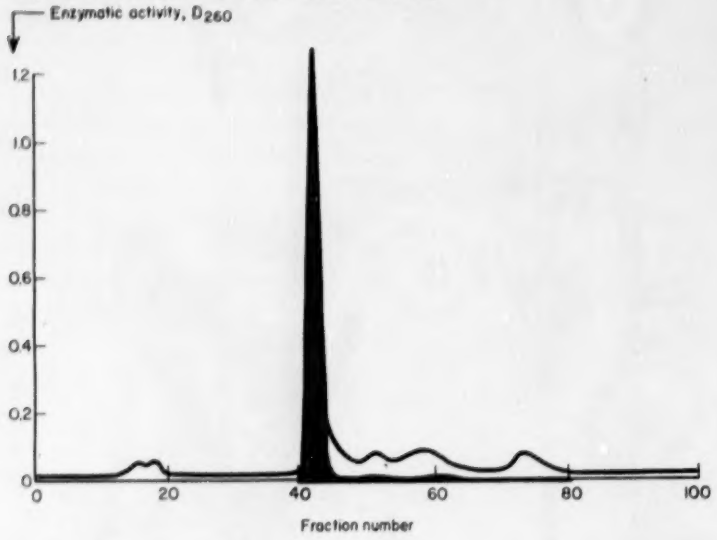
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Separated enzyme is 90 to 100% active.



Gentle Separation of Proteins

New cellulose anion exchanger can separate proteins under conditions mild enough to leave protein structure undisturbed.

Cellulose derivatives with interesting ion-exchange properties are now available from Brown Co., Berlin, N. H. These materials, it is claimed, will do things that ion-exchange resins cannot do, such as separate protein fractions without denaturation.

One of the most effective in this new family of adsorbents is diethyl aminoethyl (DEAE) cellulose. By using as starting material finely divided and highly purified cellulose, Brown can make the ion-exchange derivatives in various grades of bulk density, screen analysis and liquid-flow resistance. The substituent can also be varied; in addition to DEAE, Brown offers ECTEOLA (epichlorhydrin-triethanolamine) and CM (carboxymethyl) derivatives.

Among others, research workers at Armour & Co. have been active in exploring the properties of these materials. They have found that adsorbed proteins can be fractionally eluted with such weak acids as carbonic acid (CO_2 in water). Under such mild conditions the protein structure remains undisturbed.

Chart above shows fractionation of kidney cathepsin and liver catalase on the exchanger in a column. It resulted in a two- to ten-fold purification on distilled water-carbon dioxide elution, with a recovery of 90 to 100% of the total enzymatic activity in each case.

Complex proteins such as hormones and enzymes are easily denaturated if the condition of adsorption or desorption are not gentle. Cellulose derivatives are superior to resinous exchangers in this respect. Furthermore, the protein molecules are so large that they cannot penetrate into the adsorbent particle and adsorption occurs just on the surface. Finely divided cellulose with its very large surface area allows the attainment of reasonable capacity.

The cellulose exchangers can be used repeatedly just as resinous exchangers. They can be stored indefinitely in the dry state.

Armour is interested in potential recovery of proteins from packinghouse wastes. Brown Co. researchers also envision such possibilities as the recovery of protein from Maine potato starch wastes. Proteins could be adsorbed on the cellulose derivative, and the adsorbent plus protein could be added directly to cattle feed.

Current price for research quantities of DEAE cellulose powder is $10 for ¼ lb. or $30/lb.—**Brown Co., Berlin, N. H.**

176A

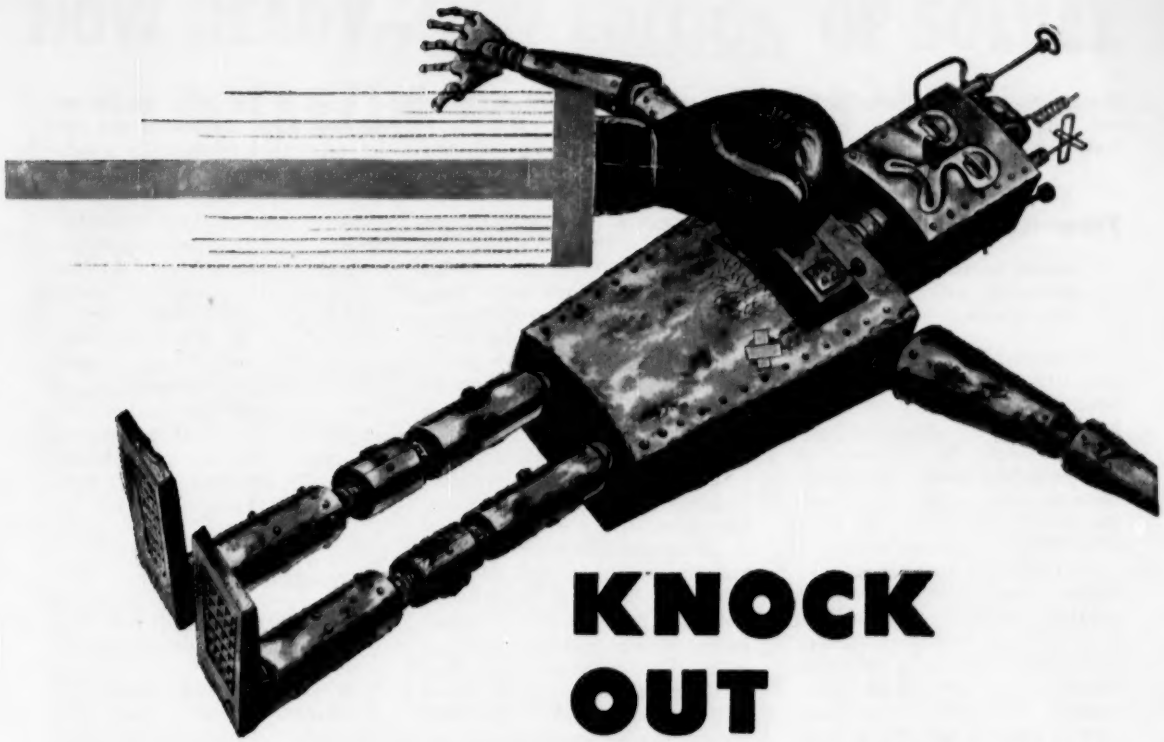
Vanadium Alloy

Self-reducing source of vanadium for electric-furnace steels.

A new self-reducing vanadium alloy now being produced commercially is said to be an economical, highly soluble source of vanadium for electric-furnace steels.

The new alloy contains a reducing agent which reduces vanadium oxide and yields vanadium quickly and uniformly to the steel bath. It has been used to add as much as 0.80% vanadium to commercial heats of tool steel, with vanadium recoveries of 98 to 100% being reported. High recoveries can also be expected when self-reducing vanadium is added to constructional alloy steels and high-temperature alloys made in the electric furnace.

In the production of tool steel, self-reducing vanadium is generally added to a well-reduced carbide slag during the finishing stages of a heat. In one series of tests, self-reducing vanadium was added to several heats of molybdenum-base, high-speed tool steel made in a 5-ton basic electric furnace. Forty pounds of vanadium per 13,000-lb. heat (0.31% vanadium) were added toward the end of the reduction period. The recovery of vanadium exceeded 98%. There was no appreciable pick-up of the reduc-



KNOCK OUT CORROSION WITH ALKATERGE-T

Alkaterge-T is fulfilling its early promise of being an exceptional oil-soluble corrosion inhibitor. It passed two commonly used screening tests with the most gratifying results and industrial users are finding confirmation in practice.

At least part of its success is probably due to its very powerful adhesion to metallic and other hydrophilic surfaces. The force required to break this adhesion has been measured at 10,500 psi — highest of any compound tested. Alkaterge-T is a big molecule and with this adhesion, powerful protection would be expected by most corrosion engineers. But Alkaterge-T has a plus value, too. Mildly alkaline, it will tie up any trace of acidity that may develop, yet it is harmless to brass. This product, therefore, should be evaluated by every manufacturer of rust preventive oils, lubricants, cutting oils, extruding oils, transformer oils, corrosion resistant greases, and spinning and throwing oils for the textile industry.

Alkaterge-T is a powerful emulsifying agent for water-in-oil emulsions and is unaffected by hard water. As little as 1% will emulsify 80% water into aliphatic hydrocarbons and form a fluid, stable emulsion. In lubricating formulations, Alkaterge-T tends to prevent sludge formation resulting from moisture pickup and should be of interest in crank case flushing oils and fuel oils. It should also be evaluated as a liquefier for the water-in-oil sludges that present severe problems in automobile crankcases, fuel oil tanks and crude oil production.

For further information and samples, write Commercial Solvents Corporation today.

ALKERTERGE-T TYPICAL PHYSICAL PROPERTIES

Color (melted), Gardner (1933)	12 max
Solidification Point, °C	59
Interfacial Tension against water, 0.1% solution in mineral oil	1.8 dynes/cm
Surface Tension, saturated aqueous solution	30.4 dynes/cm
Flash-Point	None
Solubility in water at 25 °C	0.01 ml/100 ml

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ing agent.—**Electro Metallurgical Co., 420 Lexington Ave., New York, N. Y.** 176B

Trimethylolphenol

Broad potential for use in coatings, adhesives, plastics alloys.

Trimethylolphenol in sample quantities is available for research testing and field evaluation. This new material, said to represent the ultimate in reactivity for phenol formaldehyde reaction products, will sell for about 35¢/lb. in the form of a 70% solution in water.

It represents a significant advance over previous water-soluble phenolic resins in that it is a single chemical species. Previously available phenolic resins have not been monomeric. Thus trimethylolphenol can be used as a building block to form new chemical compounds. Like its predecessors, it can also be used to form resins.

Chemical reactivity of the methylol groups makes the new material attractive as a cross-linking agent for compounds or polymers containing active hydrogens. In laboratory tests, new plastics alloys have been obtained by adding trimethylolphenol to urea, melamine, polyamino compounds, polyhydroxy compounds, phenol, substituted phenols, two-step phenolic resins, resorcinol and aniline.

BRLA 1030, the 70% aqueous solution, is dark red in color, typical of phenolic derivatives. Viscosity of the solution is 50 to 70 centistokes at 25 C. It is miscible with methyl alcohol, ethyl alcohol and acetone. It will react as a one-step phenolic resin, slowly converting to a resin at room temperature. But in the range of 150 to 160 C., it will harden in 80 to 100 sec. Reaction may be catalyzed by acids: oxalic, phosphoric or any water-soluble acid.

Most of the tests conducted to date have concerned the use of trimethylolphenol in applications where water-soluble phenolic resins have been used. However, studies have indicated that marked improvements might be expected with the use of trimethylolphenol in many of these applications.

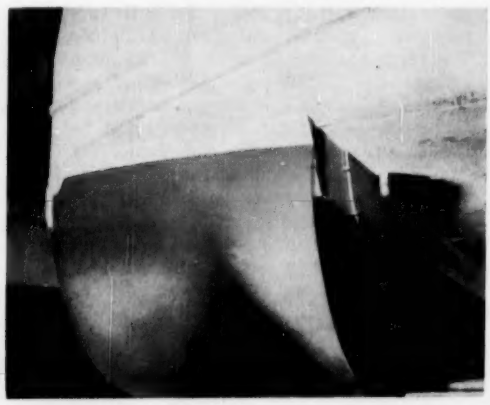
Used as a treatment for paper-base battery separators, for example, trimethylolphenol reduced water absorption and improved electrical properties in laboratory tests. **Bakelite Co., 260 Madison Ave., New York 16, N. Y.** 178A

Adhesive

Eliminates need for core priming in aircraft.

A uniquely new, high performance adhesive has been designed specifically to eliminate the need for core priming in aircraft and missile sand-





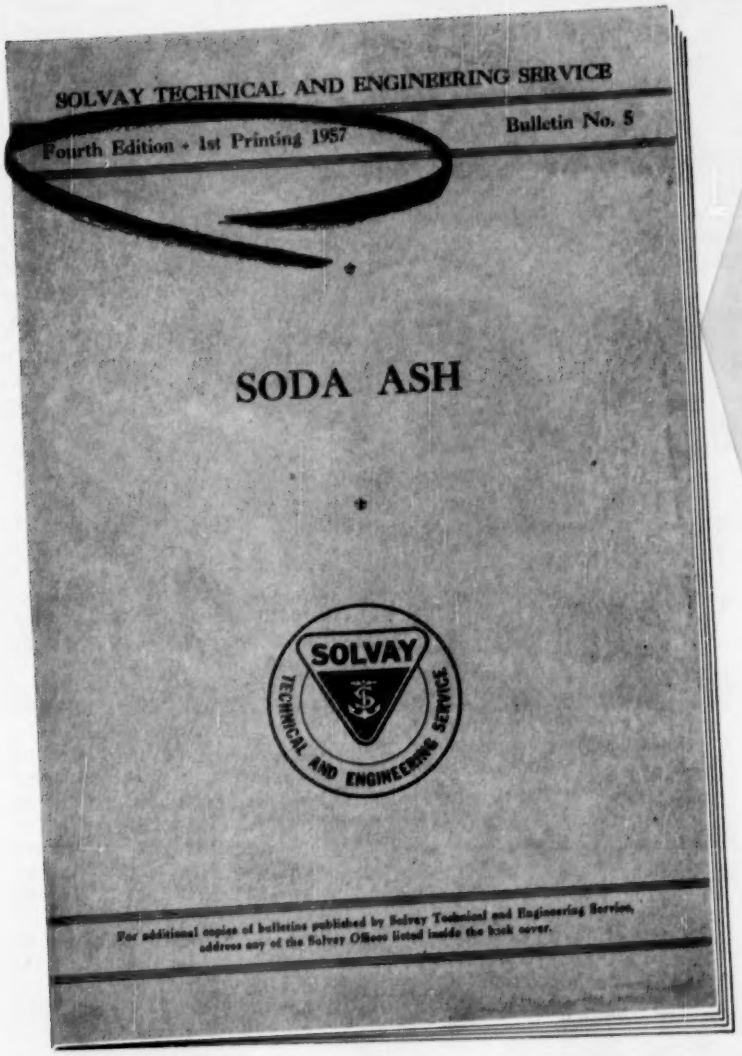
Styrofoam Pontoons Put Landbound Comforts Afloat

New Styrofoam-based pontoon construction permits boat builders to adopt luxuries formerly restricted to dry-land dwellings, may open a roomy new field for foamed plastics.

Catamarans with new Navicat pontoons are exceptionally stable because of reserve buoyancy of the flotation members. Layers of Styrofoam, a closed cell plastic weighing less than 2 lb./cu. ft., are sandwiched between sheets of marine plywood and permanently secured with bronze tie rods and waterproof resorcinal glue. Rigid assembly is housed in an armour of copper sheathing which makes painting of the pontoons unnecessary.

Level rectangular deck of pontoon-supported vessel affords maximum utilization of space, with none lost to curves and tapers. — Navicat Corp., 1246 Grand St., Brooklyn 11, N. Y. 178B

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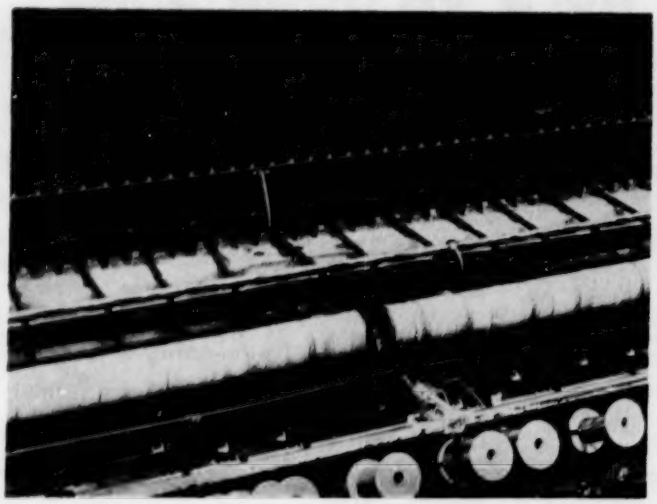
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Another Genuine Fur Moves Over for Synthetic

Persian lamb has now been added to the natural furs simulated by synthetic fibers. The new fabric, called Dynacurl, consists of a pile made with chenille yarn spun with 100% Dynel, Union Carbide's acrylic fiber, embroidered by Shiffli machine (see cut) to a durable woven cotton backing.

Dynel's thermal pliability is utilized to heat-set the curls that are characteristic of Persian lamb. Unlike previous natural or synthetic fibers tried, Dynel retains its shape and form well, is unaffected by water or moisture, will not mat down, resists abrasion.—Multitex Products Corp., Newark, N. J. 180A

wich component fabrication. It also provides materially improved peel strength.

Tradenamed Narmtape XP-108, it consists of a nylon carrier impregnated with a modified phenolic resin and overcoated on one surface with a highly mobile filleting resin.

Heretofore, it has been necessary to prime a metallic sandwich core by brush, roller or spray gun to obtain proper adhesive filleting action, then air and oven dry the core for two to three hours before bonding the face to the core.

With Narmtape XP-108, this step in the fabrication of bonded sandwich structures is completely eliminated because the filleting resin has, in effect, been built into the new, multiple-coated adhesive. Good filleting action on the part of a sandwich adhesive enables it to provide added contact area to the columns of a sandwich core.—**Narmco Resins & Coatings Co., Costa Mesa, Calif. 178C**

BRIEFS

Titanium dichloride and trichloride have been made available in multi-pound quantities at the following introductory prices: $5 to $10/lb., depending on quantity, for the trichloride; $15/lb. for the dichloride. Products are considered promising catalysts for isotactic polymerization of unsaturated hydrocarbons. — **New Jersey Zinc Co., 160 Front St., New York, N. Y. 180B**

Alkylsilanes, a new class of synthetic lubricants, have been developed by the Air Research & Development Command. They have been lab tested in jet engines where bearing temperatures approach 700 F. They also have retained their properties at −30 F.—**Wright Air Development Center, Dayton, Ohio. 180C**

Gallium 99.999% plus purity, for the most stringent applications — such as crystals of intermetallic compounds, which are known to have the most interesting semi-conductive, photoconductive and luminescent properties, is now made available by Aluminium-Industrie A.G. of Switzerland.—**United Mineral & Chemical Co., New York, N. Y. 180D**

General, economical adsorbent has been introduced: adsorptive form of practically pure silica in skeleton form. Suggested uses include removal and recovery of volatile organic solvents from wet gases and gum formers from oils, as a catalyst support, for the separation of high molecular weight hydrocarbons, and the removal of color from mineral and vegetable oils.—**Permutit Co., 330 West 42nd St., New York 36, N. Y. 180E**

Anti-static ingredient is included in new buffing compound, called PC-52, for cutting and coloring all types of plastics. Compound was specifically formulated for such thermoplastic materials as acetate, styrene and the acrylics because these softer plastics present a greater static problem.—**Hanson-Van Winkle-Munning Co., Matawan, N. J. 180F**

New coating resin soluble in mineral spirits has been developed specifically as a solution binder for coatings. Called Pliolite VT and supplied in the form of friable granules, it provides rapid wetting of color pigments.—**Goodyear Tire & Rubber Co., Akron 16, Ohio. 180G**

...more

POWELL VALVES

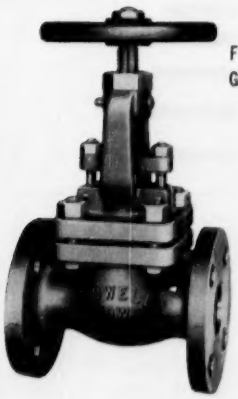


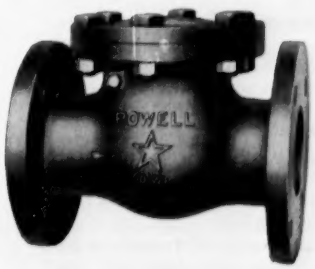
FIG. 2475—Stainless Steel O.S. & Y. Globe Valve for 150 Pounds W.P.

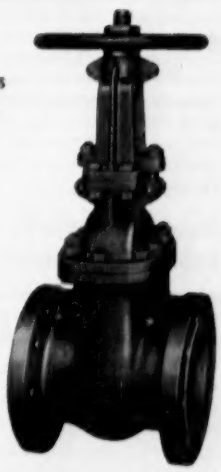
FIG. 2309 SW—150-Pound Flush Bottom Tank Valve with Powell Patented Seat Wiper.



FIG. 2456 SG—Large Stainless Steel Gate Valve for 150 Pounds W. P. Flanges conform to latest Standards.

FIG. 2433 SS—Large Stainless Steel Swing Check Valve for 150 Pounds W.P.





Designed for long life, designed for dependable service

Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. No matter what the flow control problem, a Powell Valve can solve it . . . *better.*

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR

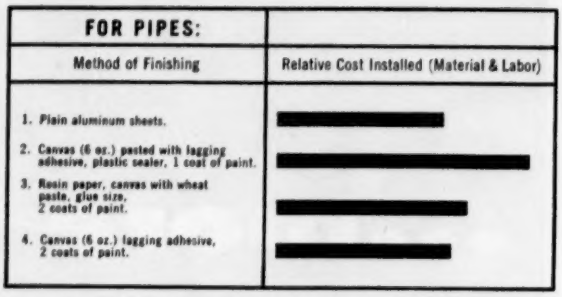
Kaiser Aluminum sheet for jacketing offers new economies through improved application methods

Recent developments make possible new low costs for the power, refinery and chemical industries

As you can see in the relative cost charts at the right, aluminum sheet jacketing now offers the *lowest first cost* of four well-known finishing methods for pipe insulation . . . and it offers *lower first cost* than wet-construction finishing methods for vessel insulation.

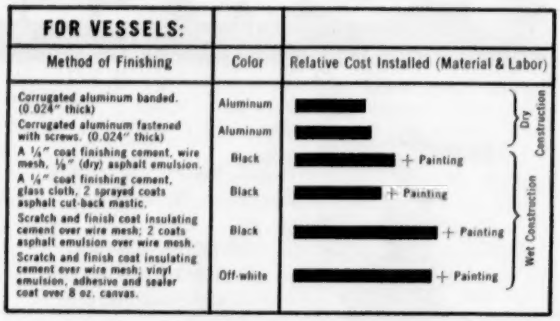
Another important fact, not revealed in the charts, is that aluminum's first cost is becoming *increasingly* competitive, thanks to newly-developed methods that speed application and reduce labor costs!

And if maintenance costs were added to the comparisons, aluminum would present an *even better value*—because only aluminum eliminates maintenance.* Its remarkable resistance to corrosion eliminates the need for painting . . . even when exposed to weather and mechanical abuse.



Results of first cost analyses of various insulation finishes

NOTE: Charts show first costs only. To arrive at total costs, maintenance costs must be added. Whereas other finishing methods require frequent and costly maintenance, aluminum jacketing is virtually maintenance-free.



New Dry Wall Construction for Vessels

A number of improvements in application technique—developed by Kaiser Aluminum engineers in cooperation with specialists from various industries—adapt dry-wall type construction to the finishing of large cylindrical and flat insulated surfaces. These techniques virtually eliminate the need for costly application methods used to apply wet materials such as insulating cements, emulsions, mastics, adhesives, glue sizing and paint. Where corrugated aluminum sheets are used, positioning and fastening are simplified and speeded by familiar techniques employed for block insulations.

New "Snap-Back" Aluminum Jacketing Speeds Installation on Piping

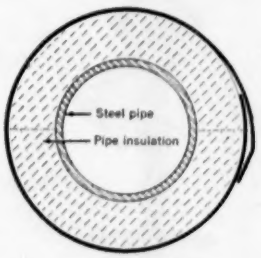
Aluminum's unique advantages in light weight and superior workability have made possible greatly simplified preformed "snap" jackets for quick, easy application on piping.

Jacketing, preformed into undersize tubes from stiff sheets of aluminum, will snap back to a tight fit when placed over pipe insulation, freeing both hands for fastening. This tight fit requires less fasteners per running foot.

The following is an outline discussion of important factors in aluminum jacketing materials and alloys, with suggested application methods best suited to various insulated surfaces, including pipes, vessels, vessel heads and others.

The Jacketing Alloys

The following aluminum alloys, supplied in flat or coiled sheets, are successfully used for insulation jacketing: 1100, 3003, 3004, 5005, 5050, 5052, Kaiser Aluminum industrial roofing and siding alloy, and Kaiser Aluminum standard roofing alloy.



Sketch shows how preformed jacketing snaps back over piping, providing quick installation combined with tight fit. This is also demonstrated in photo titled "Teamwork."

Based on maximum economy and performance, the general recommendation is the use of Kaiser Aluminum alloy 5005 and Kaiser Aluminum industrial roofing and siding.

The reasons for this recommendation, and the exceptions to it, are as follows:

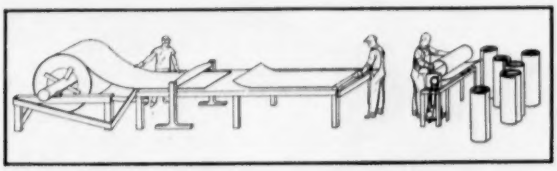
(a) Alloys in the 5000 series (which contain magnesium as the principal alloying element) and the clad alloys, such as AlClad 3004 (from which Kaiser Aluminum industrial roofing and siding sheet is made), offer superior corrosion resistance—especially in marine atmospheres.

*Roofing felt has a lower initial cost than aluminum, but painting and maintenance offset this initial cost advantage.

(b) Alloy 5005 and the industrial roofing and siding alloy provide top performance at lowest cost for most jobs. Alloy 5050 shows an advantage from the standpoint of strength over 5005, and in many instances its slightly increased cost (a fraction of a cent per square foot) is warranted. Where exceptional strength is required, alloy 5052 should be used.

(c) Closely allied with alloy selection is a consideration of the section modulus of jacketing for large diameter vertical vessels. Kaiser Aluminum industrial roofing and siding sheet is superior in section modulus. On certain vertical vessels, usually those in the range of 3′ to 12′ in diameter, some designers prefer the close-up appearance of smaller corrugations. When this is preferred, most of the common alloys and the standard corrugated roofing alloy are satisfactory. Sheets should be 0.024″ thick, embossed, corrugated to 1¼″ x ¼″, and supplied in finished widths of 26″.

A metal thickness of 0.024″ is recommended in most cases. Corrugated aluminum 0.024″ thick can be banded at less material and labor cost than the thinner 0.019″ material fastened with screws. For insulated pipes with an O.D. of 12.75″ and less, 0.020″ thick aluminum sheet is recommended.



These illustrations show method used to fabricate snap jackets:

1. Using aluminum of proper alloy and temper . . .
2. Cutting it to proper dimensions for easy, economical installation . . .
3. Properly stiffening the overlapping edge by a simple angular crimp . . .
4. Forming it through a roller for proper circumference . . .
5. Snapping it around insulated pipe (below).



Teamwork—with one man to snap jackets in place and another to band them, two men can cover 700 feet of 10-inch diameter tubing in one day!

The best temper for pipe jacketing is ¾ hard, designed as H-16 or H-36. For fitting jackets requiring numerous lock seams, ½ hard temper, H-14 or H-34, is recommended.

Pipe Jackets

Snap jackets are a quick, easy and economical method of enclosing insulated pipe. The simple process shown above produces a most effective jacket for pipe insulation. (Kaiser Aluminum's booklet, *"Insulation Jacketing Materials and Methods,"* explains and describes the process in full detail.)

The alloy recommended is 5005-H16, in coiled sheet form with plain finish. Embossed finishes are also available. Other alloys may be used, but it is desirable to use one alloy throughout. Width of coiled sheet should be 36″. Recommended thicknesses of sheets are 0.020″ for insulation O.D. of 12.75″ and under, and 0.024″ for insulation O.D. of 14″ and larger.

Vessel Jackets

Insulated vessels 36″ O.D. and less—horizontal or vertical—should be jacketed with 0.024″ thick by 36″ wide 5005-H16 alloy sheet, plain finish preferred.

For insulated vessels larger than 36″ O.D., horizontal mounting, use the same coiled sheet as above; for vertical mounting, use Kaiser Aluminum industrial roofing and siding, 0.024″ thick, embossed finished, ⅞″ deep corrugations with 2.67″ pitch.

Jackets for Large, Flat Surfaces

For breechings and ducts, indoors and out, Kaiser Aluminum industrial roofing and siding, 0.024″ and 0.032″ thick and having ⅞″ deep by 2.67″ pitch corrugations are most economical. Flat sheet, fluted sheet, and flat sheets stiffened with roll-formed standing seams offer other possibilities.

For insulated boiler walls, jackets may be made of aluminum sheets of several types. Thickness, size and fastening method will vary with specific boiler designs.

Fasteners

For pipes and vessels with insulation O.D. 36″ or smaller, bands may be slit from the same aluminum sheet used for pipe jackets, or they may be purchased as standard stock items. For pipe insulation O.D. 12.75″ and smaller, bands should be ½″ wide by 0.020″ thick, equal to A. J. Gerrard #305-AL; seals should be equal to A. J. Gerrard #202-AL. For pipe or vessels with insulation O.D. 14″ to 36″, bands should be ¾″ wide by 0.020″ thick, equal to A. J. Gerrard #311-AL; seals should be equal to A. J. Gerrard #204-AL. For vessels with insulation O.D. 36″ and larger, ¾″ wide by 0.020″ thick #18-8 stainless steel expansion bands should be used. Banding should be equal to A. J. Gerrard Expand-R-Strap, #E311 ½ S-4; seals should be #18-8 stainless steel, equal to A. J. Gerrard #204-SS.

When required for pipe and fitting jackets, #7 by ½″ aluminum pan head self-tapping screws, Type A, are suggested. Side laps and flashing with corrugated vessel jackets should be fastened with #7 x ¾″ aluminum pan head screws, Type A. Aluminum screws should be made from either 6061-T6 alloy or anodized 2024. For fastening aluminum jackets to steel structural members, use #14 hex head screws, Type B, made from stainless steel #18-8 alloy; #410 is acceptable.

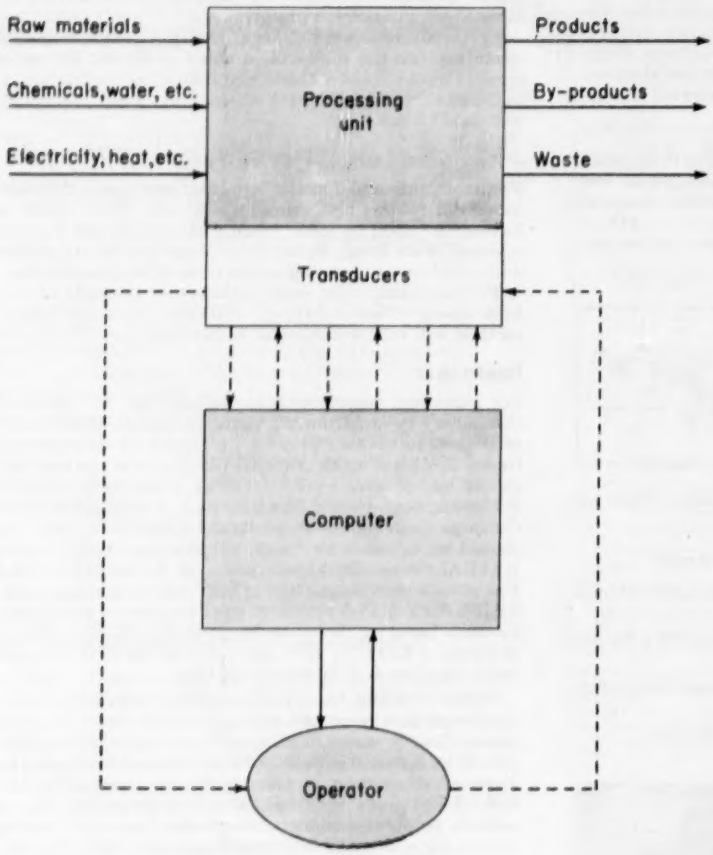
Composite studs made from #18-8 stainless steel and aluminum (equal to Nelson Rivweld Studs or to Nelson Set Lock Studs supplied with aluminum washers) may be used to fasten corrugated aluminum jackets to angles. On siding, fasten studs on low part of corrugation. On roofing, fasten studs on crown of corrugation.

Aluminum Jacketing Booklet Available

Kaiser Aluminum's new booklet, *"Insulation Jacketing Materials and Methods,"* gives you complete details on the subjects outlined above. It also presents illustrated step by step application methods plus material and accessories charts to help you take advantage of recent advances in aluminum sheet jacketing. Forty fully illustrated pages in all! To get your free copy, write to: *Kaiser Aluminum & Chemical Sales, Inc., Process Industries Department, 919 N. Michigan Ave., Chicago 11, Illinois.*



Kaiser Aluminum



Computer Can Run Process

New RW-300 digital computer can operate plant, closing the control loop. But first, you must analyze the process, then design system for computer control.

Offering you a digital computer to take over direction of your plant may seem like trying to install a gyropilot on Mayflower II. Yet, actually, the suggestion may be entirely reasonable.

Scientists and engineers working on the new RW-300 computer have studied application of digital control systems to actual manufacturing processes of several companies. They report that the RW-300 computer, operating in specific control systems, can produce tangible benefits that will return investment in the control system within one to three years.

Benefits include improved product quality, increased yield and reduced operating costs. In addition, improved control and automatic operation reduce human errors and plant upsets.

▶**Where Does It Fit**—You may ask, "Where would the RW-300 fit into control of my process?"

To answer that question, you must analyze your process carefully. Then, you can design a control system based on a complete picture of the physical and chemical characteristics together with the economic aspects.

A major problem in applying digital controls to a given process lies in development of formulas to relate operating variables to measured variables and to desired product characteristics.

However, it may be possible to ignore the effects of many variables and derive approximate relationships among some of the important ones. Operating data correlated by statistical methods may help establish relationships between operating variables.

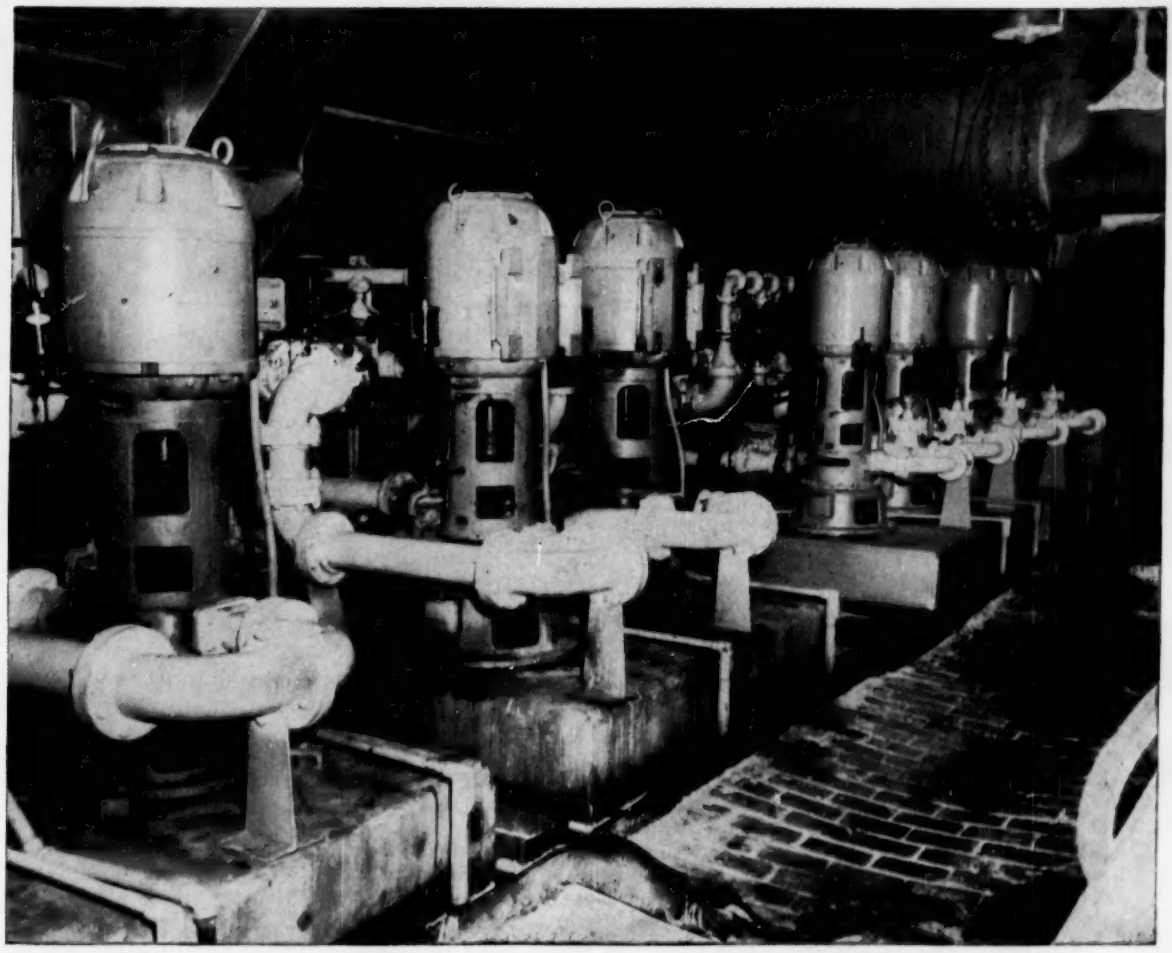
Control set up on such bases will be better than rules of thumb used by human operators. And after installation, the digital control system may provide more accurate, detailed data for improved correlations.

▶**What Does It Do**—Assuming that a computer fits into the proposed control system, what, specifically, does the RW-300 computer do?

As a central unit in a process control system, RW-300 reads process instruments automatically, computes the data to relate them to process objectives, determines control actions needed to operate the plant at optimum point, and activates process mechanisms or adjusts set points on supervised control loops.

Input to the RW-300 can be instructions or program punched on a paper tape which tell the computer what to do with subsequent information it receives. Another input would be instrument readings on temperature, pressure, flow rate or other measurable physical quantities or conditions.

All inputs would be voltages



"Plant Down Time Was Materially Reduced"

During the first three years of operation, before the LaBour pumps were installed, this contact acid plant experienced frequent shut-downs. Because the pumps are under suction lift, handling up to 98% sulphuric at temperatures up to 85°C., it was considered normal when pump packing lasted a week and there were many times when repacking became necessary in a matter of hours.

In 1946 they replaced with LaBour Type G pumps, which are packingless, and their troubles were over. Four years later when they doubled the capacity of the plant they bought more LaBours. The original LaBours are still on the job, each pumping 150 gallons per minute around the clock.

You can profit from this experience. When your process depends upon the operating continuity of a pump, you need a LaBour—and when you need a LaBour, nothing else will do. Write for full information.

LABOUR

Equipment Developments This Month

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Temperature Pickup 188D
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which vary on a scale analagous to the quantity being measured. The RW-300 converts such voltages to binary digital numbers for arithmetic manipulation.

Output from the RW-300 may be:

- Signals to control devices that adjust a process variable.
- Alarm indicating an out-of-normal value for some variable.
- Printed information.

▶ **Checking Out Problem**—A typical problem is difficult to show because, by nature, it would require tracing a very complex network. That's because any problem that justifies use of a computer is a pretty unwieldy computation in the first place. However, we can trace through one slice of a problem—a single variable in a process control system.

We shall follow what happens to information about rate of liquid flow at a given point in process. It's important because it may be a means of controlling pressure in a vessel, temperature or rate of reaction.

Most likely, flow rate will be monitored by a recording flowmeter. In turn, meter may activate a controlling mechanism, such as an automatically operated valve, to increase or decrease rate of flow, holding it near a predetermined ideal rate or setpoint.

Air signal from the meter must be transduced into a voltage signal as input for the computer. Inside the computer, this voltage or analog signal is converted into a pulse signal depicting magnitude in digital form. Then, it is stored on a magnetic drum and used in all computation operations within the computer.

Computer accepts a reading from the flow meter at a specific time in the monitoring sequence. Computer operations on the reading are controlled by the computer program.

▶ **Compute and Change**—At the proper time in the program, the flow information is picked off the storage drum and checked against high and low limits. If value is outside these limits, computer may recheck, take corrective measures or indicate the condition to the operator.

If reading is acceptable, it may be compared with previous readings to highlight any trend and determine rate of change. When an entire series of system variables has been read, checked and registered, machine may use them to compute control equations. Answers tell where to set process variables to achieve process objectives.

Required changes in variables are issued as digital answers to the control equations. Either directly, or after conversion, these digital signals can actuate the control mechanisms. If our flow rate requires change, the signal adjusts the set point of the flow recorder-controller to the desired new value.

While the RW-300 operations require only milliseconds of time, elapsed time for the entire control cycle will be governed by the response time of the process.

▶ **Versatile**—Flexibility of the RW-300 design permits modification and improvement of its control actions as indicated by operating experience, or as

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FLAT SURFACE FOR BETTER DISPLAY...



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Let us start you off with all the "F" style cans you need. Sizes four ounce (spout top) to one gallon. Then, if you need engineering or research help, it's available as part of our Tailor-Made Package Service. Call soon for the packages with more "see," more "sell"—Continental "F" style cans. Rapid delivery from shipping points across the U. S.

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more input instruments become available. It can be changed from one process to another, from data logging to fully automatic on-line control, or scientific and engineering computations.

Unit is fully transitorized, measures only 55 in. long, 29 in. wide and 36 in. high. Control console is 29 in. high. Computer weighs approximately 400 lb.—**Ramo-Wooldridge Corp., 5730 Arbor Vitae St., Los Angeles 45, Calif.** 184A

Transducer

For remote indication or control of valve position.

With a recently developed valve-stem transducer, position of the valve stem may be sensed, then indicated, recorded or controlled. Device is used where safety or product quality depends upon the proper setting or functioning of a control valve.

Electrical output signal from the transducer allows a wide choice of readout instrument. Transducer consists of a finely wound slidewire and a contacting brush which is positioned by the valve stem via an adjustable connecting link.

Valve stem travels of 0.25 in. and longer can be accommodated. In ranges from 0.25 to 1.0 in., sensitivity is 0.0007 in. Above 1 in., sensitivity is 0.001 in.—**H. E. Sostman & Co., 347 East Lincoln Ave., Cranford, N. J.** 188A

Automatic Analyzer

Performs spectro-photocolorimetric analyses.

Water and industrial solutions may be analyzed automatically by the Controlmaster process analyzer to provide continuous reliable control of composition. Device can be used to measure and record any determination which develops color or turbidity in proportion to the substance being determined.

The Controlmaster collects a sample from the flowing process stream, filters it and adjusts temperature. Then, it measures precisely the sample volume and the required amount of reagent(s).

After mixing sample and reagent, instrument analyzes the mixture and indicates the results. Whenever process conditions exceed a predetermined limit, the Controlmaster signals an alarm. It can be linked to the process equipment to regulate feed rate. If desired, it can be connected with computers or recorders.—**Vericontrol, P. O. Box 22, New York 71, N. Y.** 188B

Tank Gage

Assures long, efficient, trouble-free gaging.

Exceedingly high accuracy is reported for the new No. 30 tank gage. Claim is based on tests conducted in conformance with API gaging committee standards and on performance on tanks under actual service conditions.

Gages are easy to check, adapt easily to remote reading, can be installed easily on new tanks or those already in service. Friction has been reduced to a minimum so that shafts turn freely making the gage sensitive to any change in liquid level under all temperature and service conditions. Gage compensates for the weight of the tape mass which tends to alter the position of the float.—**Johnston & Jennings Co., 6917 Bessemer Ave., Cleveland 27, Ohio.** 188C

Equipment Cost Indexes

	March 1957	June 1957
Industry		
Avg. of all	222.2	224.1
Process Industries		
Cement mfg	213.1	215.3
Chemical	223.3	225.5
Clay products	207.0	209.2
Glass mfg	210.9	213.0
Paint mfg	214.8	216.6
Paper mfg	215.2	217.3
Petroleum ind	219.3	221.1
Rubber ind	222.1	223.9
Process ind. avg	220.7	222.8
Related Industries		
Elec. power equip	225.6	228.4
Mining, milling	224.7	226.9
Refrigerating	250.9	253.0
Steam power	210.3	212.0

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124–6 for method of obtaining index numbers; March 1957, pp. 266–7 for annual averages since 1913.



Temperature Pickups

Offer high response speed in non-corrosives.

Temperature of non-corrosive liquids and gases can be sensed very rapidly with a new line of high-speed precision platinum resistance thermometers. Because the exposed platinum sensing element contacts the environment almost immediately, response time is less than 2.5 sec. in air and less than 50 millisec. in water.

Units operate over a temperature range from −320 to +750 F. Accuracy is better than ±1% of full scale with repeatability of better than 0.2%. Up to 5 v. can be delivered directly to telemetry commutation circuits without additional amplification.

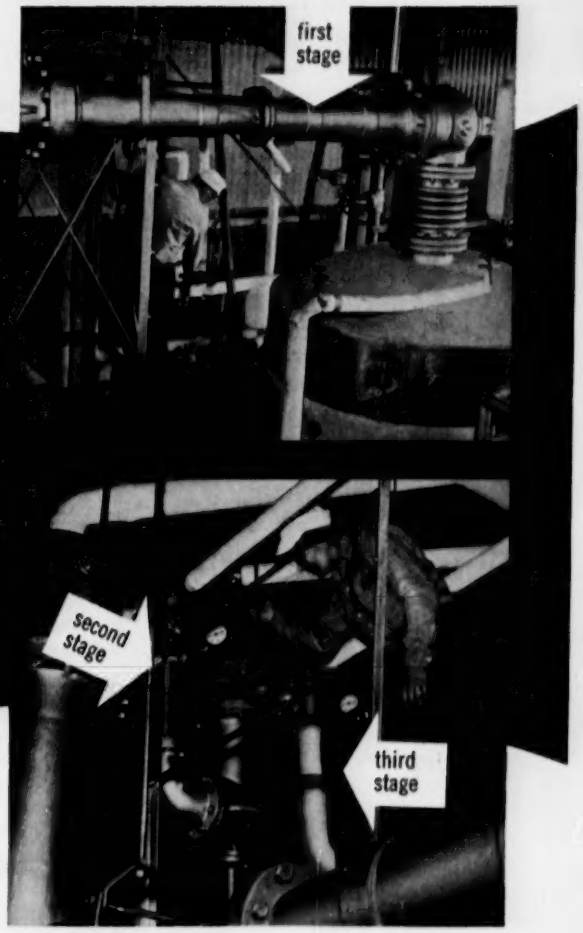
Pickups can withstand pressures up to 1,500 psia. The platinum winding is protected completely by a stainless-steel cage. —**Trans-Sonics, Inc., Burlington, Mass.** 188D

Oxygen Analyzer

Continuously monitors oxygen in plant streams.

Oxygen content in the range of parts per million can be monitored in process plant gas

this ELLIOTT three-stage EJECTOR maintains absolute pressure of 0.25 in. Hg in deodorizer

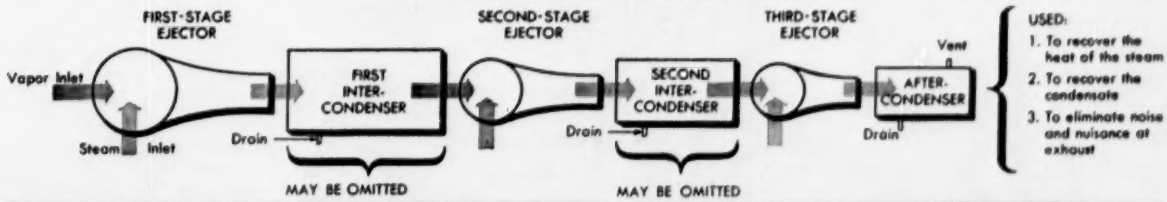


This typical installation serves a continuous lard deodorizer that deaerates, heats, deodorizes and cools in a single vessel. Function of the Elliott three-stage steam jet ejector is to continuously maintain an absolute pressure of 0.25 in. Hg throughout the entire deodorizing vessel.

The first or booster stage seen in the upper photo, compresses stripping steam and discharges to a barometric-type booster condenser, where both motive and entrained steam are condensed. The lower photo shows the second-stage and third-stage ejectors with intercondenser, which compresses noncondensable gases to atmospheric discharge.

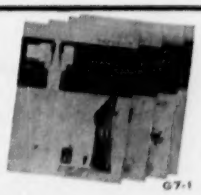
The installation illustrates Elliott's wide experience in designing and building multi-stage ejectors for process industry applications. Three-stage ejectors—such as in the schematic hook-up below—are usually applied where an absolute pressure from 1.00 to 0.10 in. Hg is required. Condensers may be either barometric or surface type. For more than 40 years, Elliott steam jet ejectors have proved themselves—again and again—to be a simple and dependable method of maintaining low absolute pressures. Consult with the Elliott ejector specialist at the nearby district office about your requirements, or write Elliott Company, Jeannette, Pennsylvania.

SIMPLIFIED SCHEMATIC of THREE-STAGE EJECTOR



ELLIOTT Company

Ask for ENGINEERING DATA which covers the complete range of Elliott steam jet ejectors including single-stage, special corrosion-resisting, and various multi-stage types.

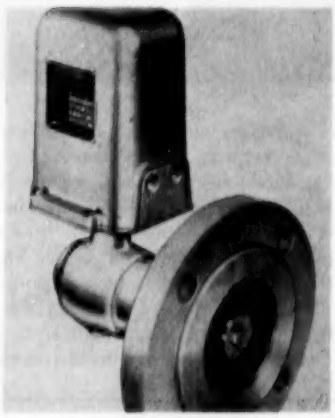


G7-1

streams by the new Series 11-4000 oxygen analyzer. Units are available to record, control, indicate or telemeter to remotely located receivers.

Instrument measures the electro-chemical change of an oxygen-sensitive reagent when it is exposed to a gas sample that contains oxygen. A regenerator continuously reduces the oxidized liquid so that it may recycle in a closed loop arrangement. Full range sensitivity can be had for any oxygen value from 0.50 ppm. to 0-2,000 ppm.

Applications for this instrument include control of trace oxygen during polymerization of butadiene, ethylene, etc.; determination of oxygen in nitrogen, helium, argon and other inert or noble gases; detection of oxygen impurity in hydrogenation processes; monitoring of oxygen content to prevent catalyst poisoning.—**Davis Instruments, 80 Halleck St., Newark 4, N. J.** **188E**



Level Transmitter

For viscous liquids or slurries in vessels.

A simple method for measuring level of viscous liquids or slurries in tanks is available through use of the Type 13 FA d/p cell transmitter.

Device operates on the force-balance principle and maintains calibrated accuracy over a wide range of ambient conditions. No auxiliary signal amplifier is needed. Purging systems are not needed since viscous liquids are measured at tank side without running through tubing.

Measuring element is a silicone-filled diaphragm capsule which is assembled in a 3-in. flange that mounts flush on the side of a vessel. Head of liquid applies force to the high-pressure side of the capsule which is opposed by force on the low-pressure side. Low pressure side may be open to atmosphere for measurement of level in an open tank. Or, it may be connected by piping to the top of closed tank to balance out static pressure.—**Foxboro Co., Foxboro, Mass.** **190A**

Conductivity Detector

Measures electrolytic conductivity without electrodes.

New method measures solution conductivity where fiber, abrasive slurries, heat or strong corrosives interfere with standard electrode techniques. It is recommended only for use under such conditions.

A flow-type sensing device installed either on the main plant stream or a sampling line contains a flow sensing element and components to compensate for temperature. Input and output toroids with single windings are mounted on the flow-type cell.

Input toroid is connected to the transmitting unit which is a source of stable voltage in the high-audio-frequency range. Receiver unit connected to the output toroid reads the voltage developed across its winding.

Flux linking these two toroids is contained entirely within a loop of liquid and the coupling between the toroids is a function of the conductivity of the solution.—**Industrial Instruments, Inc., 89 Commerce Rd., Cedar Grove, N. J.** **190B**

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Vapor Fractometer

For stream analysis, field tested for year.

Design of the model 184 vapor fractometer is based on experience with 10 interim experimental instruments which have been operating on chemical and petroleum processes during the past year.

Unit sets up easily to analyze several constituents on a wide variety of process streams. Simple in design and construction with all components easily accessible, it should prove to have low maintenance costs.

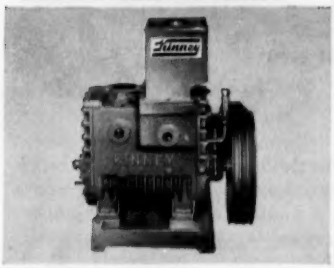
Instrument has been field tested on such analyses as butadiene product and raw material, alkylation feeds, ethylene, chlorinated hydrocarbons and general refinery streams containing both olefins and paraffins from methane through pentanes and pentenes. Other particularly promising applications include analysis of synthesis gases used in making ammonia, acetylene, methanol and ethylene oxide.

Standard model 184 records from 1-4 constituents directly on a bar chart presentation. Chart can be set to read directly in percent. Standard columns, available with the instrument, range up to 50 ft. long and special ones may be ordered.—**Perkin Elmer Corp., Norwalk, Conn.** **190C**

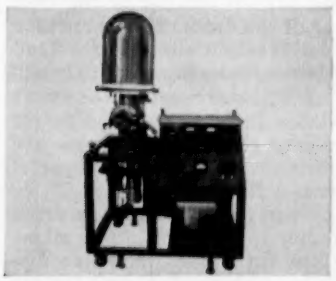


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KINNEY Pumps range in free-air displacement from 2 to 5000 cfm and ultimate pressures of 10 microns to 0.1 micron (McLeod).



KINNEY High Vacuum Equipment includes Evaporators, Furnaces, Ovens, TV Tube Aluminizers, Pumping Systems, Power Units and High Vacuum Test Equipment.

High Vacuum is a "lot of nothing" that adds value to old products, multiplies the number of new products and deducts many of the unsolved problems of the process industries. Today's Vacuum technology is changing many a static business into an active, progressive and profitable operation. Just as High Vacuum is making big changes throughout industry...the field of High Vacuum itself is undergoing important changes.

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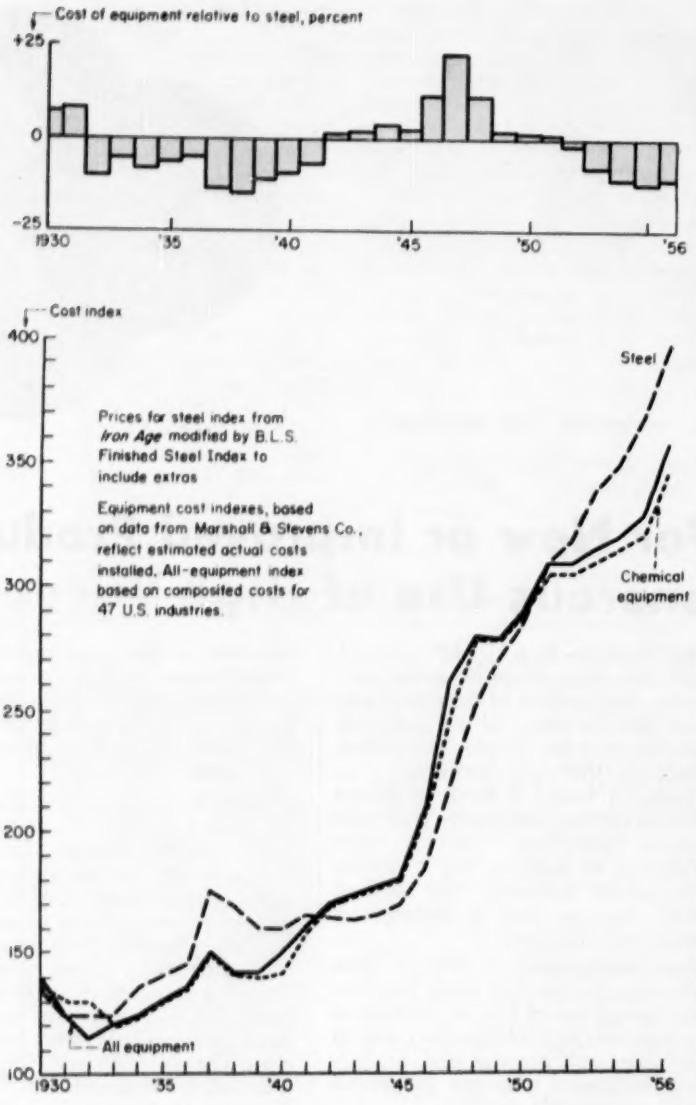


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How Steel and Equipment Price Indexes Compare



If you've been wondering what is going to happen to equipment costs in response to rising steel prices, Singmaster & Breyer's plot (above) may help you. S. & B. plotted this chart because equipment prices jumped fast last year, after rising rather slowly during the preceeding 3-4 yr. Result shows how fast relative prices have changed. It raises the question, what will they do next year and the year after? Frank Breyer of S. & B feels that equipment prices will continue to rise as fast as they did in 1956 with a good chance that they may even accelerate. History shows that equipment prices lag steel prices by about 5 yr. Slope of the steel-price-index curve probably will increase. To get back in line, equipment costs will have to increase even faster than they did last year. Copies of original plot, including 1914-1930, are offered by Singmaster & Breyer, 420 Lexington Ave., New York 17, N. Y. 192A

Freeze Dryer

For R & D work and moderate-scale production.

Operation of the new model 2003F2 vacuum freeze dryer offers in one machine the efficiency of large industrial units combined with flexibility of small laboratory-scale models. For that reason, it is suitable for research and development work as well as for moderate-scale production.

Completely self-contained, model 2003F2 has its own electrically heated and thermostatically controlled hot water system that circulates water through the drying shelves. Together with the Freon compressor and other accessories, it is housed in a cabinet below the vacuum chamber. Behind the vacuum chamber is a high-capacity, mechanical vacuum pump.

Product is pre-frozen on the two lower shelves at −40 F. Then, it is transferred to the two upper shelves for drying under high vacuum by sublimation. Total area of the drying shelves is 4 sq. ft.— **F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. 192B**

Mixer

Mixes more thoroughly in much shorter time.

Claiming to break a present bottleneck in industrial mixing, the Turbine Type mixer mixes up to six times as fast as other available types and actually homogenizes materials, it is said.

Mixer has a doughnut-shaped mixing drum with the drive mechanism located in the center of the drum. This particular configuration eliminates a dead center producing a "live mix."

Peripheral speed of the mixer blades is high over the entire mixing area. These blades are positioned to braid the material at a 9 ft./sec./rate.

Open top of the mixing drum permits charging the mixer from any angle. Machine discharges through a semicircular door in the bottom of the tank.

Turbine Type mixers are available in ½-, 1- and 1½-yd.



An old bromide about chlorides!

The old bromide that a salted tail immobilizes a bird has frustrated children for generations. Another old bromide that chlorides are ruinous to engineering metals has plagued design engineers for decades. That was before titanium.

Strong ferric, stannic and mercuric chloride solutions have no effect on titanium. Extraordinary resistance to mineral acids is shown by excellent performance in boiling 65% nitric acid.

Boiling glacial acetic, concentrated lactic and concentrated formic acids are completely resisted by titanium. Even vapors are non-corrosive.

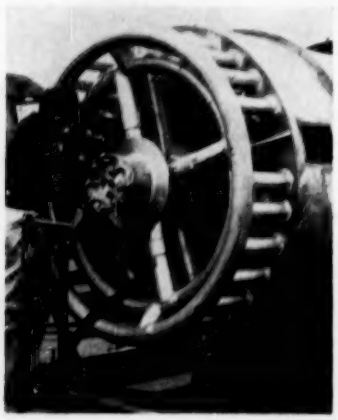
Titanium is more than a "promising" metal for the chemical-processing and pulp industries. It's already paying for itself in applications where severe corrosion once posed forbidding maintenance or design problems. Titanium means longer service life, less down-time.

All forms of titanium—tubing, sheet, wire, strip, plate, extrusions, bar and billet—are routine production items for TMCA, at prices attractively competitive with other engineering metals. Extensive research facilities and trained technical service personnel are available to provide quick answers to specific requests.

. . . FIRST IN Titanium

TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.

sizes.—**T. L. Smith Co., 2835 North 32nd St., Milwaukee 1, Wis.** 192C



Steam Tube Dryer

Welded aluminum construction for polymer drying.

Considerable savings in cost of dryers has been realized at the W. R. Grace low-pressure polyethylene plant at Baton Rouge through use of all-welded aluminum construction. Product requires an inert drying atmosphere and the equipment must not contaminate the product.

With the exception of tires, driving gears, trunnion roll assemblies and bed frame, the dryers are constructed entirely of aluminum with stainless steel pads separating the dissimilar metals to prevent electrolytic corrosion. Double seals for all connections between the shell and the hoods maintain a tight seal inside the dryer. Steam is supplied through a floating-type rotary joint made entirely of stainless steel and aluminum parts.—**Standard Steel Corp., 5001 South Boyle Ave., Los Angeles 58, Calif.** 194A

Gas Generator

Produces inert carbon dioxide-nitrogen mixture.

Employing entirely new design principles, the Thermal inert gas generator produces an inert atmosphere that is essentially carbon dioxide and nitrogen. Primarily, it is intended to meet the needs of industry for inert gases to blanket or purge hazardous locations of combustible atmospheres.

Heart of the generator is Thermal's patented short-flame combustion system, fired either with gas or oil. Burner fires directly into a column of water which cools the hot combustion gases to the desired temperature. There is no need for a complicated heat exchange system such as commonly used with conventional inert gas generators.—**Thermal Research & Engineering Corp., Conshohocken, Pa.** 194B

Tower Packing

Now available in carbon material.

Intalox saddle packing now is available in carbon material, according to a recent announcement. Product is result of a joint research by U. S. Stoneware Co. and National Carbon Co.

Carbon Intalox saddles are recommended particularly for operations involving hot alkalis, mixtures of hydrofluoric and sulfuric acids, or hydrofluoric and phosphoric acids. Their low coefficient of thermal expansion prevents spalling under abrupt changes in temperature.—**U. S. Stoneware Co., Process Equipment Div., Akron 9, Ohio.** 194C

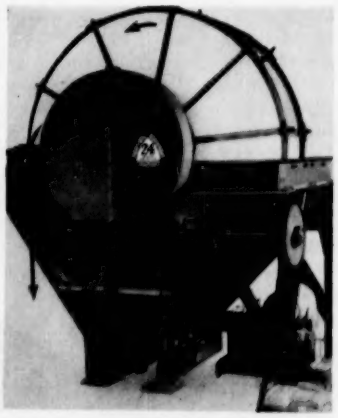
Radiation Facility

Available on time rental basis for research or production programs.

A 2-Mev. Van de Graaff generator now is available on an hourly rental basis at High Voltage Engineering Corp.'s, Burlington, Mass., plant. Designed for both independent laboratory investigations and productions runs, the facility aims to encourage new applications and technical advances in the use of high-energy electron radiation.

Generator is mounted vertically with an effective electron beam width of 15 in. Within a few minutes, the equipment can be converted to deliver X-rays. It is possible, therefore, to do experiments with both electrons and X-rays in the same day.

Material to be processed is loaded into aluminum trays that travel under the Van de Graaff on a belt-type conveyor. For high doses of radiation, the conveyor can be set to reverse automatically for sufficient time to reach the desired dose.—**High Voltage Engineering Corp., Burlington, Mass.** 194D



Disk Filter

Has new agitator that eliminates sealing trouble.

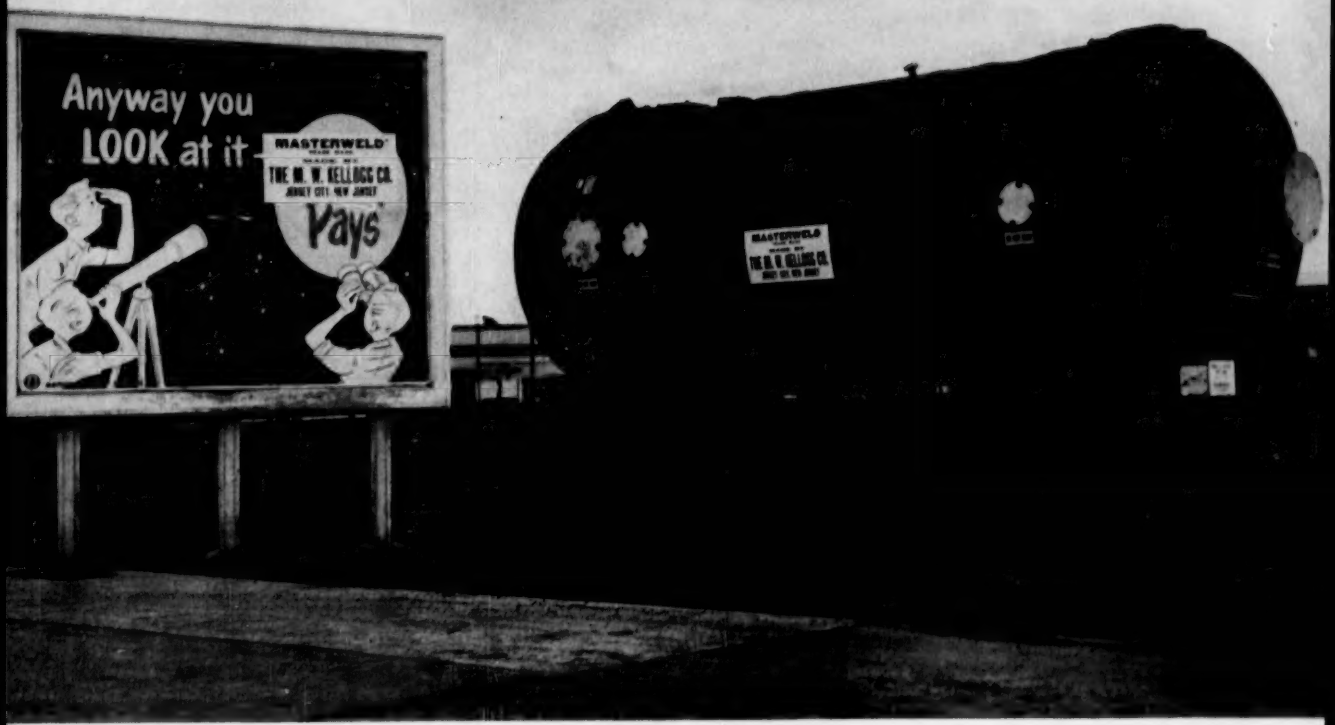
Both increased filter capacity and easy maintenance are reported for a new agitator type disk filter.

A pulsating unit, located below the filter disks, agitates the slurry. Because of its design and location, agitator keeps the solids suspended.

Speed of pulsation can be varied to maintain a homogeneous pulp regardless of the nature of the solids. Result is greater capacity and lower final moisture because the cake is distributed more uniformly over the filter sector.

Agitator mechanism can be removed easily for service. However, maintenance problems are negligible because packing gland, sealing water and bearings have been eliminated.—**Denver Equipment Co., P. O. Box 5268, Denver 17, Colo.** 194E

Pride that Pays Off



Kellogg's plant people at Jersey City showed justifiable pride in their work when they modified this familiar sign in the company's railroad siding.* On its way to a major chemical company, the Masterweld unit is one of the largest heat exchangers ever built. Whether your heat transfer requirements need specially designed giants like this or standard type units, the personal pride of Kellogg's personnel in their designing, engineering, and fabrication pays off in longer and more satisfactory service for Kellogg's customers.



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• With apologies to National Safety Council Inc. for the temporary defacement.

Two-Ply Plastic

Resists wider range of corrosive chemicals.

A new two-ply type lightweight plastic construction material has been developed for severe corrosive fume service. A solid combination of two laminates, Rigiply insures long service life at minimum maintenance cost.

Rigiply can be engineered and fabricated for use in fume exhaust hoods, ducts, stacks, fume scrubbers and tank covers. It resists a much wider range of chemicals, including both acids and alkalies than has been possible with laminates of fiber-glass-reinforced thermosetting resins in the past.—**Heil Process Equipment Corp., Dept. G., 12901 Elmwood Ave., Cleveland 11, Ohio. 196A**

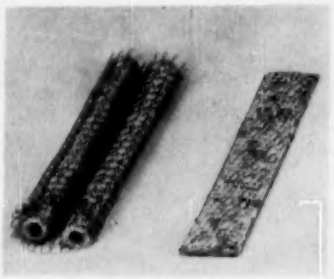
Aluminum

For high temperature made by powder metallurgy.

First aluminum products produced by powder metallurgy techniques are now available in the U. S. According to Alcoa's announcement, these products establish a major breakthrough the thermal barrier which has barred use of aluminum in numerous high temperature applications. They are available in the form of extruded shapes, forgings, sheet, foil, drawn and extruded tube, impact extrusions, fasteners and wire.

Aluminum powder metallurgy (APM) products are made from fine, unalloyed aluminum powder. Each tiny flake has an oxide coating which greatly strengthens the product and contributes stability at high temperatures. These properties are developed during compacting and working of the metal powder.

Costwise, APM products are more economical to use than titanium and are easier to fabricate. Thermal conductivity greatly exceeds that for either titanium or stainless steel. For applications involving friction, APM parts can be anodized. And they also can be electroplated by regular methods.—**Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa. 196B**



Tray Gasketing

Asbestos-wire seal cuts leakage across tower trays.

Leakage across fractionating tower trays has been reduced appreciably at an East Coast refinery through use of new Metex Tray Seal. Also, this new gasketing has proved easier and quicker to install. Made of pure asbestos fiber and knitted Monel wire, it is available in the two forms shown above.

Tray gasketing used previously by the refinery permitted an atmospheric crude oil pipe still operating at 200 F. to develop leakage 370% above allowable after one year of operation. No longer was the gasketing resilient and its cotton content had charred away, leaving open spaces along the joints.

After installation of Metex Tray Seal, still leakage was 6% under allowable and rose to only 67% above allowable during one year of operation.

As a result, gasketing has been installed in vacuum tower where temperatures run 730-750 F. At start of vacuum tower run, total tray leakage was 19% below normal. As yet, tray leakage has climbed only to 4% above allowable.

While Tray Seal is more expensive than conventional asbestos-cotton tape, results obtained in operation are claimed to more than justify its cost.—**Metal Textile Corp., Roselle, N. J. 196C**

Fibrous Sheets

Of Teflon resin, look good for filtration.

Armalon tetrafluoroethylene fibrous sheets, now under development by Du Pont's Fabrics Div., offer interesting prospects in filtration processes.

Laboratory data indicate that Armalon fibrous sheets effectively remove fine particles from liquid suspensions under severe conditions or from hot corrosive gases. Because they are not wetted readily by water, the new materials also may be useful for separating water droplets from many organic liquids, such as gasoline.

Since the Armalon sheets are made from Teflon tetrafluoroethylene resin, they are serviceable at temperatures from below −100 to +400 F. They will withstand attack from strong acids and bases and are not affected by water or any common fuels, lubricants, hydraulic fluids and solvents.—**E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. 196D**

Kiln lining bricks of 70% alumina are now available with extra high density, low porosity and high strength. Suited especially for cement and lime kilns, they come in standard sizes and special shapes.—**Ironton Fire Brick Co., Ironton, Ohio. 196E**

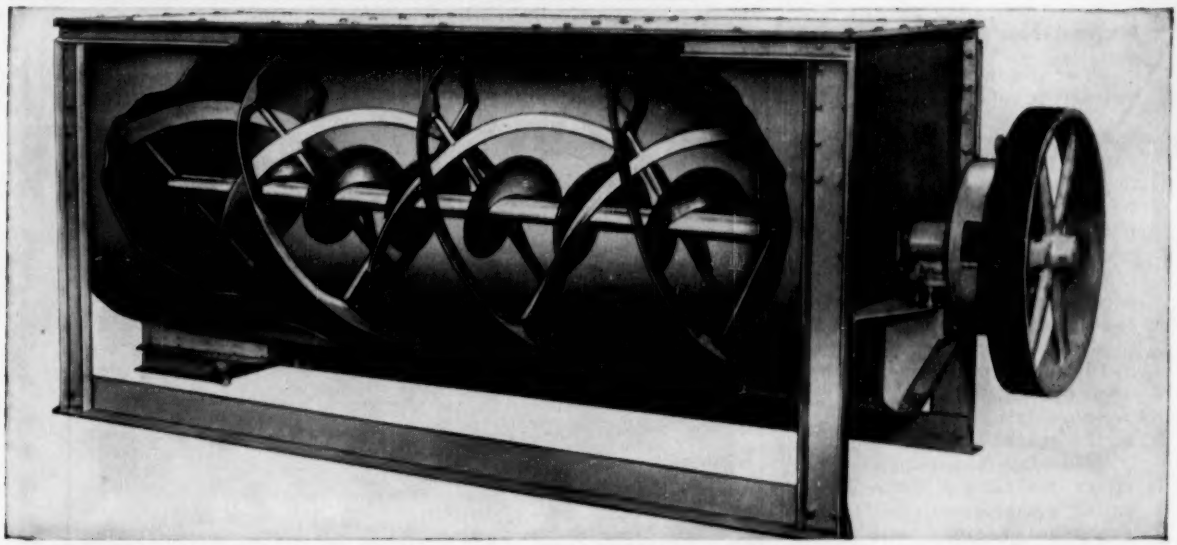
Stainless steel plate or bars of any analysis are now cut to finished dimensions by supplier's new wet-process abrasive saw. Cuts are clean and smooth without heat tint or carbide precipitation.—**Chicago Steel Service Co., Chicago, Ill. 196F**

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PRECISION MIXING WITH NEW TRIPLE ACTION MIXER

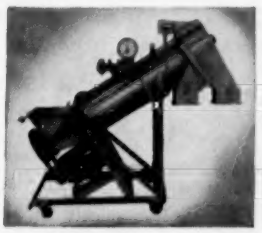
Strong-Scott Mixer Offers Uniform Blending and Mixing in 2 to 7 Minutes with 99.9% Thorough Distribution of Minor Additives.

Now, for the first time, a batch mixer with exclusive "Triple Action" mixing. The blending, folding and mixing action created by this unique triple ribbon and spiral assembly exposes each particle in the mixture to over 10,000 separate mixing actions per minute. The center spiral breaks and tumbles the core of the mix and moves the material to the outer 2 ribbons which convey the ingredients in opposite directions, subjecting each particle to thousands of mixing actions per minute. This produces a well balanced, uniformly mixed product of the highest efficiency known.

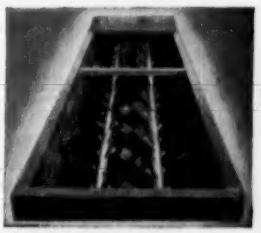
EXCLUSIVE FEATURE — Nylon seals between the tub and shaft, with outboard bearings. This permits cleaning in a matter of seconds . . . is sanitary, long wearing and dustproof. There is no hold up of product from one batch to the next.

The versatile design of the Triple Action Mixer permits feeding from any location at the top with single or multiple discharges to suit individual requirements. Hinged, drop-door bottoms for easy cleanout. Constructed of steel, stainless steel or commercial alloys.

Strong-Scott maintains a complete Customer Service Laboratory with a full line of standard equipment for your convenience, with no obligation to you. Consult Strong-Scott for additional details.



PORTA-BLEND—A portable dry mix and liquid blender capable of quality results at high capacity.



TWIN ROTOR MIXERS—Accurate blending of liquids and dry mix at high or slow speed.

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Expansion Engine

For liquefied-gas service, drives compressor.

A new reciprocating piston engine is designed to recover the expansion energy on gas liquefaction service and deliver it as shaft horsepower to compressor or generator.

Engine performs well at temperatures down to −300 F. and can handle inlet pressures up to 3,000 psig. An air flow of 250 lb./min. at 3,000 psig. inlet pressure and 250 psig. outlet pressure develops over 200 bhp. at the crankshaft.

Used in conjunction with either centrifugal or reciprocating compressors, the JX-14 expander engine will find widest use in the cryogenic field. Such applications include production of liquid oxygen, nitrogen and other gases and the separation of gases by liquefaction.—**Cooper-Bessemer Corp., Mt. Vernon, Ohio. 198A**

Industrial Lighting

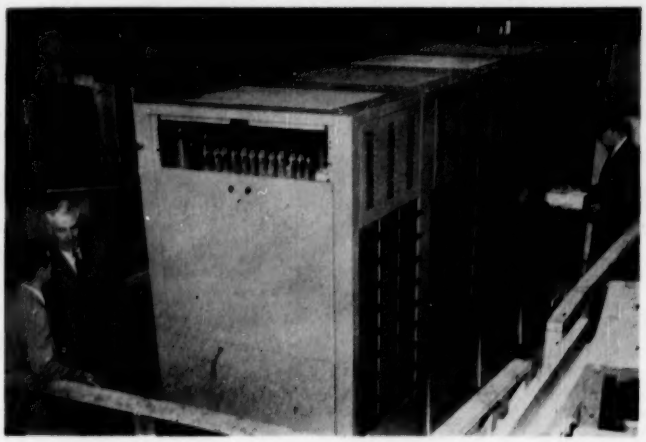
New installation reaches higher lighting levels.

What's claimed to be a major breakthrough of the "sight barrier" has been achieved with an installation of fluorescent lamps which produces the highest level of comfortable lighting anywhere. Reaching a lighting level greater than 1,000 footcandles, this setup employs Power-Groove fluorescent tubes at high frequency in specially designed fixtures that are now available commercially.

Most industrial and commercial lighting installations are considered well above average if they have general lighting levels in the range from 100 to 200 footcandles. As recently as one year ago, a comfortable 1,000 footcandle lighting level could not have been reached.

The Power-Groove lamp contains a series of lengthwise grooves which double light output. A high frequency circuit, operating at 400 cycles rather than the conventional 60 cycles, makes possible a 20-lb. reduction in ballast weight per fixture and less heat given off.

Fixture has an all-aluminum reflector and louver mounted on a white enamel channel. Cost to operate 27 fixtures occupying a 15 x 24 ft. area is 15¢/hr.—**General Electric Co., Nela Pk., Cleveland 12, Ohio. 198B**



Power Rectified by Germanium for Chlorine Cells

This rectifier cubicle is the first of 18 that collectively will comprise the nation's largest germanium rectifier installation. Slated for Diamond Alkali Co., Houston, Tex., this rectifier will be completed late this year, will be rated at 35,000 kw. Output will be 140,000 amp. d.c. for chlorine production, L. W. Morton of G. E. (left, facing camera) feels that this installation "marks an important milestone in the growing trend toward the use of semiconductor power rectifier systems in heavy industry." — General Electric Co., Schenectady 5, N. Y. 198C

Industrial Stethoscope

Tunes different sound levels in or out.

Used like a doctor's stethoscope, the Airsonic instrument allows the maintenance mechanic or engineer to listen to all the internal and external sounds of a running machine. Then, it is easy to locate malfunction, defect or excessive wear. Device also can check flow of liquids, air or gas to localize leakages.

Ability to isolate a particular sound is the most important feature of the Airsonic. Through use of a patented regulator, instrument can be adjusted to a desired frequency. Sounds that normally might be drowned out by other sounds are isolated and amplified so that they are distinguishable.

Airsonic is reported to be non-electric and has no membrane which might distort the sound.—**M. Paquet & Co., Inc., 17 Battery Pl., New York 4, N. Y. 198D**

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Tight Control At High Temperatures



When a circular chart recorder was used to monitor temperature regulation in CEC's Chromatograph, the curve showed only slight temperature variations–even less than a guaranteed ±½°C. With the instrument's temperature absolutely controlled, zero drift in the output signal becomes negligible–a fact very important to accurate measurements This kind of precision is typical of the Type 26-201's ability to maintain constant sample size, constant carrier flow rate, and constant temperature. Unlike other chromatographs, the 26-201 uses no vacuum tubes. The heated sampling valve eliminates both sample contamination and condensation. Sample volumes are consistently reproducible to better than ±½%. These exclusive features make it practical to use peak height for analytical computations, thus simplifying data reduction. Contact your nearby CEC field office for complete information, or write for Bulletin CEC 1831-X28.

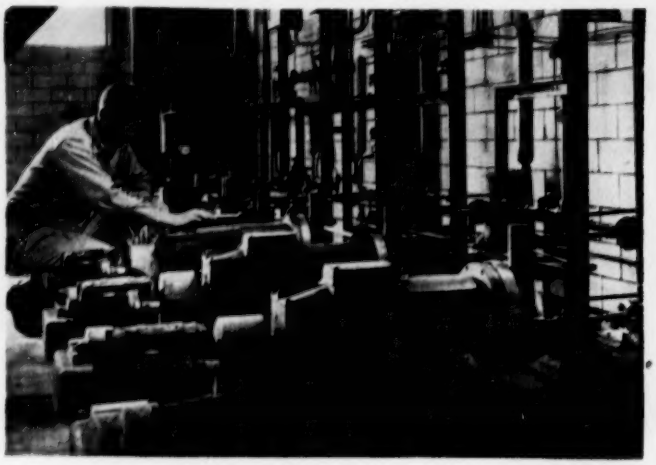
CEC's CHROMATOGRAPH

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Pumps Control Quality of Niacin Output

Battery of positive displacement pumps delivers accurate proportions of feed streams during production of niacin from quinoline at new plant of Koppers Tar Products Div., Arroyo, W. Va. Plant also will work on development of economical methods of production and commercial application of high-boiling, coal-tar fractions that have not been produced commercially, as yet.—Lapp Insulator Co., Process Equipment Div., 34 Gilbert St., LeRoy, N. Y. 200A

Variable Pump

Controls flow of corrosive, abrasive slurries.

The Vanton variable-flow-rate pump-motor set has been designed specifically for pilot plant, laboratory or process work. Driven by a variable-speed drive, the Vanton pump gives a relatively linear relationship between speed and output.

Speed may be varied by a hand-operated, variable-pitch pulley or by an integral variable-speed motor drive controlled automatically by an air cylinder. A 3-15 psi. air signal is the sensing and controlling portion of the system. Signal pressure controls the power air through an amplifier, thus controlling speed of the pump drive.

With this type of pump motor system, you can proportion flow, maintain constant liquid level and handle other types of process variable-control problems. Featuring the unique flex-i-liner, these pumps are self-priming with flow rates from less than one to 40 gpm.—**Vanton Pump & Equipment Corp., 201 Sweetland Ave., Hillside, N. J. 200B**

Positive Pump

Vents excess discharge pressure back to suction.

A vented cover now available for the Waukesha positive displacement pump automatically protects against overpressure on the discharge. It eliminates need for troublesome bypass assemblies, extra nuts, ferrules, tubing and relief valves, as well as the time and labor for assembly, disassembly and cleaning.

A cover that screws onto the end of the pump contains a chamber sealed by a rubber or Kel-F diaphragm. In turn, this diaphragm closes off a passage between the discharge and suction sides of the pump. Air or gas pressure is adjusted within the chamber to provide the required degree of sealing pressure.

When back pressure on the pump exceeds the pressure within the chamber, the diaphragm lifts allowing the pressure to equalize. — **Waukesha Foundry Co., Waukesha, Wis. 200C**

Flexible Connectors

Stainless steel, available as full line.

Stainless steel flexible connectors are now available in a full range of stock sizes and lengths. Widely used throughout industry to eliminate pipeline problems caused by rigid connections, they resist corrosion, pressure and heat. Their flexibility permits movement, compensates for misalignment and dampens vibration.

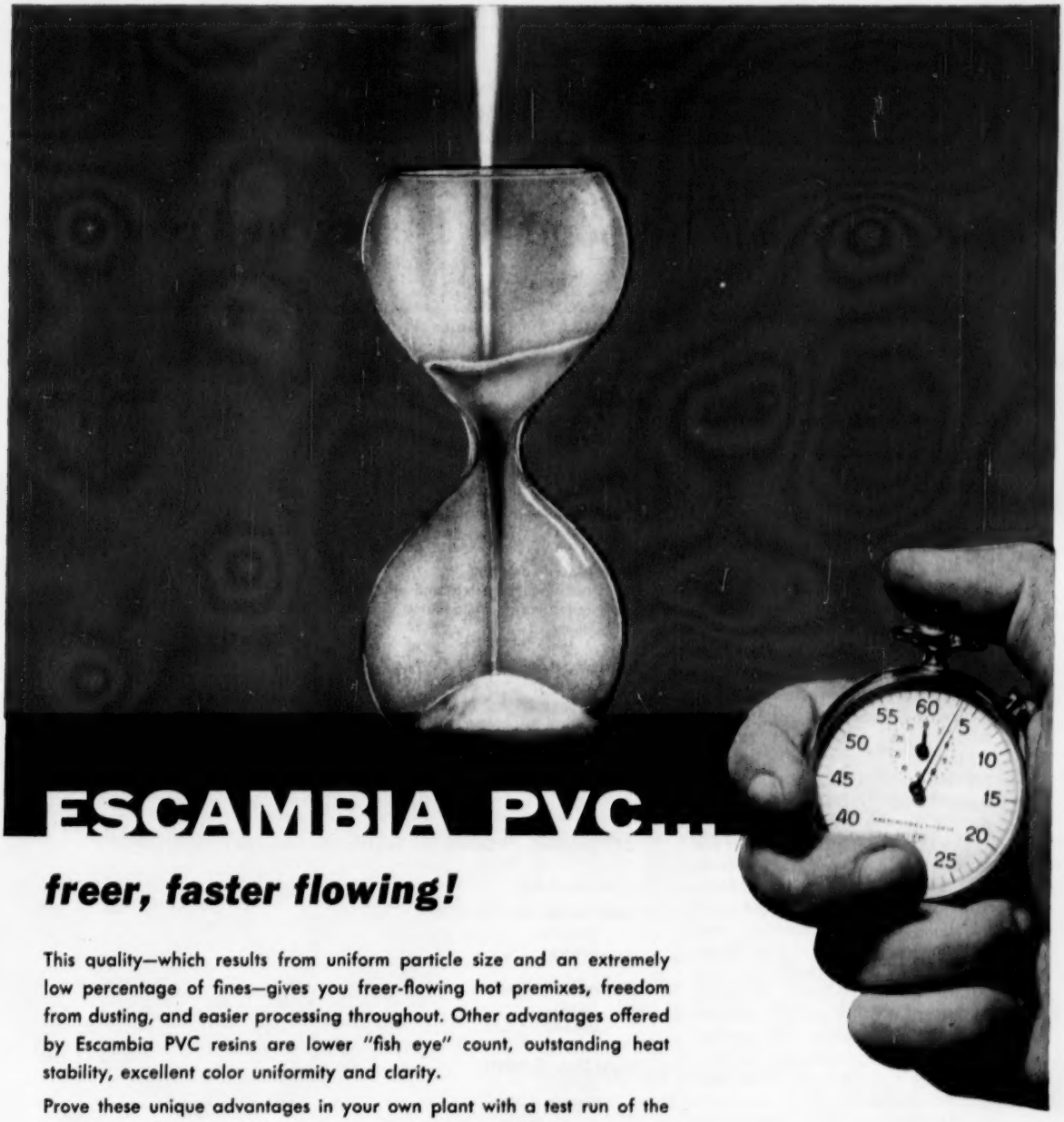
Allflex connectors are available in all standard sizes through 4 in. in any required length. They can be furnished with any standard or special fittings or flanges for end connections. — **Allied Metal Hose Co., 3732 Ninth St., Long Island City 1, N. Y. 200D**

Packless Pump

Proportions fluids accurately up to 2,500 psi.

A new addition to the McCannameter line of pumps incorporates a Teflon-faced diaphragm. Solid Teflon covers and is permanently bonded to an elastomeric backing. Result is long diaphragm life.

Pump performs with exceptional accuracy and minimum maintenance at pressures up to 2,500 psi. It incorporates packless design, capsulated construction and smooth continuous flow in a wide output range. — **Hills-McCanna Co., West Nelson St., Chicago 18, Ill. 200E**



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Raw Materials Respond to Detergent Trends

Trends in detergents—syndets for toilet bars, heavy duty liquids in the washing machine—mean plenty to chemical makers.

Can synthetic bar detergents banish toilet soap from the powder room? Will Our Gal Sunday fall for heavy-duty liquids in the laundry?

Corny questions in the best soap opera tradition. But meaningful, nevertheless, because answers to questions like these would tell chemical makers which, and how much, of the myriad soap and syndet raw materials will be needed come, say, 1960.

What's at stake? Markets for active detergents themselves: Alkyl aryl sulfonates; fatty alcohol sulfates; sulfonated fatty alcohols, ethers, amides and glycerides. Markets for detergent builders: Phosphates (sodium and potassium); silicates, soda ash, sodium sulfate, sodium perborate. Markets for optical brighteners, perfumes, soil-suspending agents and other specialty chemicals.

Significance of the two most-talked-about trends—syndet bars in place of toilet soap, liquid rather than solids for heavy duty washing—can be summed up quickly: Tide (and other heavy duty solid syndets) and toilet soap are still out in front—way out in front.

CHEMICALS: Nonionics Shine

	Production, million lb.			
	'56	'60	'56	'60
Builders			2,100	2,230
Phosphates	970	1,010		
Others	1,130	1,220		
Anionic Surfactants			625	700
Alkyl aryl sulfonates	470	525		
Sulfonated alcohols and esters	140	140		
Others	15	35		
Nonionic Surfactants			210	310
Nonsulfonated esters and others	125	195		
Nonsulfonated amides and amines	82	112		
Others	3	3		
Specialty Additives			18	21
Carboxymethylcellulose	11.4	14.0		
Perfume oil	4.6	4.8		
Optical brightener	1.8	2.1		

DETERGENT PRODUCTS: Watch the Liquids and the Bars

	Sales, million lb.			
	'56	'60	'56	'60
Total Soaps and Syndets			4,583	4,920
Syndets	3,075	3,650		
Soaps	1,510	1,270		
Heavy Duty Syndets			2,220	2,475
Solids	2,200	2,250		
Liquids	20	225		
Light Duty Syndets			840	1,040
Solids	550	630		
Liquids	290	410		
Toilet Bars			590	651
Soaps	578	550		
Syndets	12	100		

▶**Steady Toilet Soap**—Syndet bars first broke into the toilet bar market in 1954—to the tune of 3-4 million lb. First quarter sales this year of all solid syndets increased only 11 million lb. over 1956's first quarter. At the same time, toilet soap sales stepped up by 20 million lb. (somewhat at the expense, it seems, of white laundry bars).

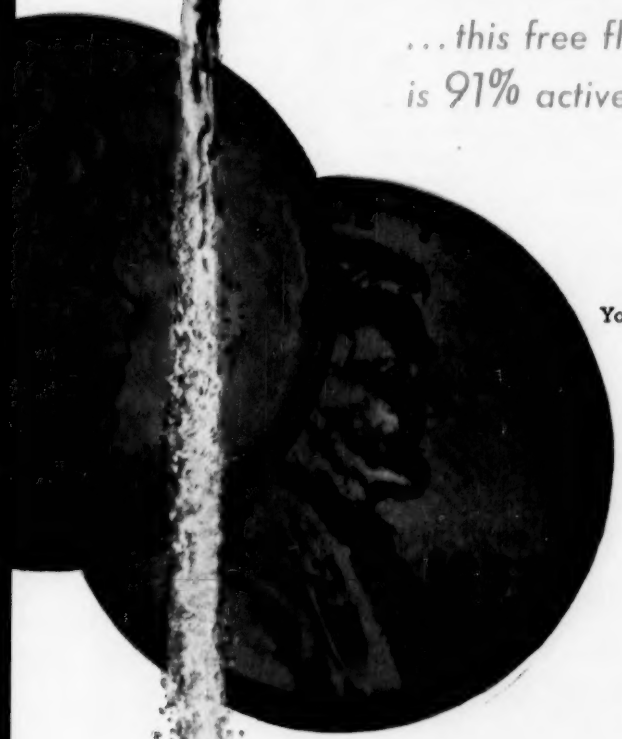
Not much headway for syndet bars in those figures.

Liquid detergents' stunning rise (up 66% in '55, another 70% in '56) seems to have run out of steam, at least temporarily. They'll probably pick up another 20% this year according to sales figures thus far, but will still have only about 10% of the total syndet market. With light duty liquids obviously gaining favor there doesn't seem to be much room in present sales figures for the heavy duty variety. We say "obviously" because sales of light duty packaged soap products (chips and granular) are losing, in terms of pounds, almost exactly what all liquid syndets are picking up.

Now although it seems pretty clear that there'll be no head-

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... this free flowing solid is 91% active chemically



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long displacement of toilet soap and heavy duty solids, syndet-containing bars and heavy duty liquids will come in time. Furious competition in the soap and syndet industry will see to that.

▶**Question of Solubility**—When heavy duty liquid syndets catch on, look for potassium builders, particularly the phosphates, to become very busy (along with KOH producers). They're more soluble than their sodium counterparts.

Another answer to the solubility problem: Hydrotropic agents like sodium toulene sulfonate which may soon have markets 3-4 times as large as those they hold now (7 million lb./yr).

The most satisfactory builders, like the alkaline polyphosphates and silicates, tend, at useful concentrations, to salt out both cationic and anionic detergents. Here's where the hydrotropic solubilizer comes in.

Most commonly used detergent products today, such as the alkyl aryl sulfonates, are being adapted to use in liquid form, so no great market swing appears imminent. (Nonionics could grow in importance in heavy duty washing because they are more soluble as a rule than the anionics.)

Not so with toilet bars. In this area most big volume syndets are not too well suited for toilet use. At least the ingredients used so far are such things as sulfonated glycerides and amides. But you can bet your last soap coupon that toilet bar manufacturers will use the cheap alkyl aryl sulfonates if it's humanly possible.

▶**Soap Hangs On**—If synthetic bars really go to town, soap markets could shrink by as much as 50%—to about 15% of the present market for all cleaning compounds. That's all the damage syndet bars can do since the toilet bar market now takes less than 40% of all soap (although it returns half the profits). Rest goes to still-stubbornly-entrenched laundry bars, chips and granulated products.

Some of these latter soap products will continue to give way slowly to syndets for household use. But syndets will find the going tough—as they have always have—in the commercial laundry business. Laundries can buy bulk materials like silicates, phosphates—and soap—more cheaply than they can purchase them in a compounded blend.

▶**Detergent Compromise**—Should syndets, as is likely, have to settle for a combination bar, look for soap to continue strongly. Soap now claims about 85% of a toilet bar. An added syndet shouldn't take more than about 20% of a combination bar. Hence soap should wind up with no less than half of the "beauty bar of the future."

As low foaming detergents grow in importance—the increasingly popular front-loading, washer-dryer favors this—foam-boosting alkylolamides will step aside to make room for less-frothy nonionics based on ethylene oxide and ethers, phenols and glycols.

Nonionics, in general, have other properties working for them: Bland effect on the skin (big play in dishwashing compounds and toilet soap) and greater solubility (important in heavy duty syndets).

In light-duty syndet powders alkyl aryl sulfonates have displaced lauryl sulfate. But in light duty liquids lauryl sulfate has found a new home, as have sulfated nonionics and alkylolamides (for greater solubility).

▶**To Please the Senses**—Some chemicals—like optical brighteners and perfumes—will prosper regardless of further shifts in soaps and syndets. Aromatic chemicals and essential oils used as perfumes in wash day products now run about $40 million/yr. Markets in five years should be crowding $45 million.

A whole new area for dyestuff manufacturers, the optical brightener, has evolved. Half of all soaps and syndets contain about 0.1% of a brightener (usually a fluorescent dye)—a $15-million market in all.

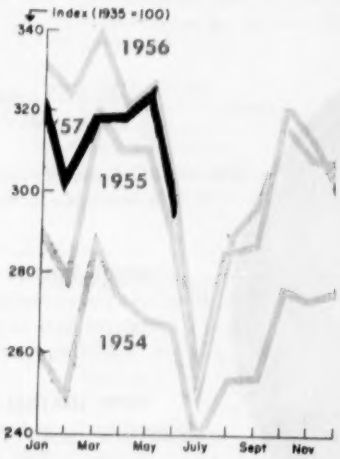
Heavy duty liquids can be sold eventually to the housewife almost solely on the basis of convenience offered, even if the washing costs are slightly higher, and the performance standard slightly lower, than the solid products. But the convenience must be unmistakable—the kind afforded by a washer with a built-in dispenser.

There's a catch here, though: It'll take something like ten years to replace all present-day washers with those equipped with a liquid dispenser. Thus Tide-like detergents can hang in there a good while. And they'll only give way, dispenser or no dispenser, if the liquids can be made reasonably comparable in cost and performance, which they don't appear to be yet.

With all-important potassium builders costing half again as much as their sodium counterparts, competitive pricing is a nice problem for the maker of a heavy duty liquid syndet.

We can't see an all-synthetic

Chemical Consumption



Consumption by Industries

	May (Final)	June (Est.)
Coal products	12.3	11.6
Explosives	11.7	9.7
Fertilizer	70.7	56.9
Glass	27.5	27.9
Iron & Steel	18.0	17.2
Leather	4.1	4.1
Paint & varnish	37.9	36.8
Petroleum refining	32.4	30.8
Plastics	25.7	23.4
Pulp & paper	38.0	35.7
Rayon	27.7	25.1
Rubber	7.1	6.2
Textiles	10.4	8.9
Total	324	294



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detergent bar taking over the toilet bar market. Soap holds too many cards in this highly specialized field: It has all the advantages except resistance to hard water. Syndets will correct this deficiency—to the tune of perhaps 20% of the bar—but soap will stay on to provide a good share of detergent action, ought to retain half of the "new" bar.

▶ **Liquid-Solid Struggle**—There are production problems, too. The all-syndet bar is much tougher to make than is soap. Either the syndet bar must be adapted to present bar-soap equipment (which is not likely) or new processing facilities are needed—a tough proposition for the small manufacturer.

Be sure of one thing, though. If the all-syndet bar or syndet-soap bar sells in any one place it will sell everywhere—soft water or no soft water. The rise of the synthetic detergent after World War II is a dramatic precedent. No one was more surprised than the syndet manufacturer when every area of the country put syndets on its shopping list.

How Much Do Radioisotopes Save Industry?

Applications	Million Dollars in 1956	
Thickness gaging		**63**
Metals	23	
Rubber, tire fabrics	14	
Plastics, adhesives	3	
Paper, allied products	19	
Other products	4	
Liquid-level, moisture, hydrogen-carbon-ratio gaging		**4**
Radiographic testing		**42**
Corrosion studies		**4**
Tracing		**197**
Oil well logging	20	
Oil well stimulation	150	
Pipeline oil flow, catalyst circulation	1	
Petroleum refining	8	
Other tracing	18	
All other industrial uses		**82**
Total Savings		**392**

Hot Isotopes Build Up Steam

What's all this to a chemical engineer? There'll be no bigger user—or maker—of radioisotopes. And he'll need a zillion instruments to keep tabs on them.

"Economic feasibility of private enterprise participation in radioisotope production appears imminent." Hopeful words from the Atomic Energy Commission, prompted, no doubt, by results of its spot check this year of industrial roles already played by hot isotopes. (See table above.)

The AEC could be right. Because even now a quickening market pace for government-produced radioisotopes is evident in reports of distribution and use of isotopes and radiation instruments—and the savings to industry thereby.

If this pace holds up through the next couple of years industry may well feel justified in investing in its own radioisotope production reactors.

• AEC's spot-check survey puts the finger on industry savings through isotope use at around $400 million a year. With this as a starter, some predictions see annual savings within five years at ten times this level. Industry saved perhaps $100 million in 1953.

• AEC capacity for radioisotope production will reach a level of more than half a million curies this year, four times greater than capacity last year.

• Fifteen hundred industrial organizations now have licenses to possess and use radioisotopes. In 1953 the figure was only 800. Half of the 500 largest manufacturing companies use isotopes.

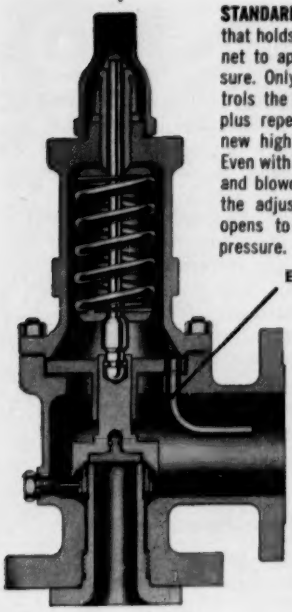
• Nearly 100 firms are now busily processing and distributing hot isotopes—vs. 17 in 1951.

• A private nuclear instrument industry supplies nearly all equipment requirements of both government and industry projects.

▶ **Get Your Isotopes Here**—Private firms, of course, have been busily processing and distributing radioisotopes since the program's beginning ten years ago. And the pace is quickening. Tracerlab will soon move into expanded facilities at Waltham, Mass. Abbott Labs in Oak Ridge, Tenn., doubled its plant for isotope processing. The Budd Company's Nuclear Systems Division recently completed a hot cell for handling 10,000 curies of cobalt 60.

As for radioisotope production, AEC's Savannah River plant will turn out 200,000 curies of cobalt 60 this year, pushing total Commission capacity to 300,000 curies/yr. of cobalt 60. Oak Ridge National Laboratory last year produced 116,000 curies of radioisotopes ranging from cobalt 60 to gold 198—twice what it delivered in 1955.

A new $2-million fission products pilot plant on stream this

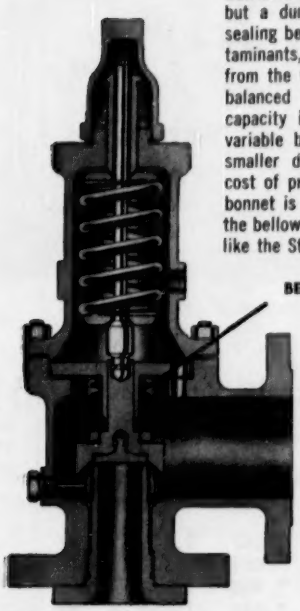


STANDARD VALVE. Note the eductor tube that holds the pressure in the valve bonnet to approximately atmospheric pressure. Only the force of the spring controls the valve. Far better valve action plus repetitive flow capacity assure a new high in operational dependability. Even with repeated popping, set pressure and blowdown are consistent. Whatever the adjusting ring position, the valve opens to full capacity at 10% over-pressure.



LOOK INSIDE

before you buy another safety relief valve



BELLOWS VALVE. Similar to the Standard, but a durable, two-ply stainless steel sealing bellows effectively isolates contaminants, corrosion or viscous fluids from the working parts. The bellows is balanced with the seating surface — capacity is less seriously affected by variable back pressure, so the use of smaller discharge piping reduces the cost of pressure-relieving systems. The bonnet is vented to the atmosphere. If the bellows ruptures, the valve operates like the Standard valve.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

LOOK INSIDE the Consolidated Safety Relief Valve. Fewer functional parts and precision machining and alignment of parts assure long valve life and less maintenance. Economical "2 in 1" design permits the Standard valve to be converted to the Bellows type right in your own shop.

There is only one adjusting ring—it can be set easily *before* valve installation to obtain peak performance at 4-5% blowdown. *Full-rated relieving capacity* is certain at all positions of the ring because a fixed maximum secondary orifice provides full lift at 10% over-pressure. *Valve action is consistently positive* even where "superimposed" back pressure is in the relieving system.

The temperature-compensating disc eliminates seat distortion caused by temperature-induced stresses — always seats tightly even when reasonable strains of unanchored discharge piping are present. A minimum guiding area is provided to align the seating surfaces — less chance of a sticking disc holder when corrosion or contamination build up on the guiding surfaces. The seating surfaces are optically-ground flat for easier, more economical servicing.

The contours of the huddling chamber and secondary orifice take full advantage of the stream pressure and kinetic forces. No other valve has this safety feature. Note the low placement of the threaded section that holds the nozzle in the valve. It assures high resistance to discharge piping strains — no leakage resulting from strain induced into the nozzle.

BE SURE OF ABSOLUTE PROTECTION for personnel and equipment — plus low maintenance. Select Consolidated Safety Relief Valves. Full range of sizes and pressures available with standardized inlet and outlet face-to-face dimensions for easy interchangeability with the valves of some other manufacturers. *Write for Catalog 1900.*

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

Instruments for Isotope Use

	Number of Licensed Installations
Gaging Thickness	**842**
Metals	185
Rubber, tire fabrics	120
Plastics, adhesives	108
Paper, allied products	299
Other products	130
Gaging Liquid Level	**300**
Moisture, H_2-C Ratio	
Radiographic Testing	**500**

year at Oak Ridge will be able to separate 200,000 curies/yr. of cesium 137, plus substantial amounts of strontium 90, cerium 144 and technetium 99.

No wonder isotopes are getting cheaper. Not too long ago cesium 137 sold for $100/curie. Today's price is about $14. Oak Ridge production is expected to drop it to something between $1 and $5.

▶ **Cheap at Any Price**—For some jobs, though, isotopes can be considered bargains even at present prices. Several firms estimate radioisotope radiography can be accomplished for one-eighth to one-tenth the cost of X-ray inspection. An average-sized foundry can set up nondestructive isotope testing for $5,000-10,000.

To install a beta ray density gage for controlling thickness of, say, plastic, rubber, paper or sheet metal, you'll have to lay out a little more—$25,000-30,000. But thickness gages usually pay off the initial investment in less than a year—generally within a few months.

And even a saving of a penny or two per ton of product handled via isotope control could net millions where materials like coal and petroleum are concerned.

▶ **Instrument Detectives**—Since radioisotope utilization requires radiation detection and measurement, let's look at the instrument market. (See table above.)

More than 3,300 gages of various types—thickness, liquid-level, moisture—have been licensed to industry. Yet this is hardly scratching the surface. More than 2,200 of these went to the cigarette industry. Furthermore, the AEC asserts that markets for radioisotope thickness gages are less than 10% saturated.

And although half of the 500 biggest U. S. manufacturers use radioisotopes, less than 0.5% of all (300,000) mining and manufacturing concerns in the nation do the same.

Industry also needs low-level counting equipment to measure activity equal to, or less than, normal background. An isotope added to a product in process (and which will remain with the product), so that its movements can be traced and perhaps automatically controlled, must decay to insignificant activity before the product is offered to the public.

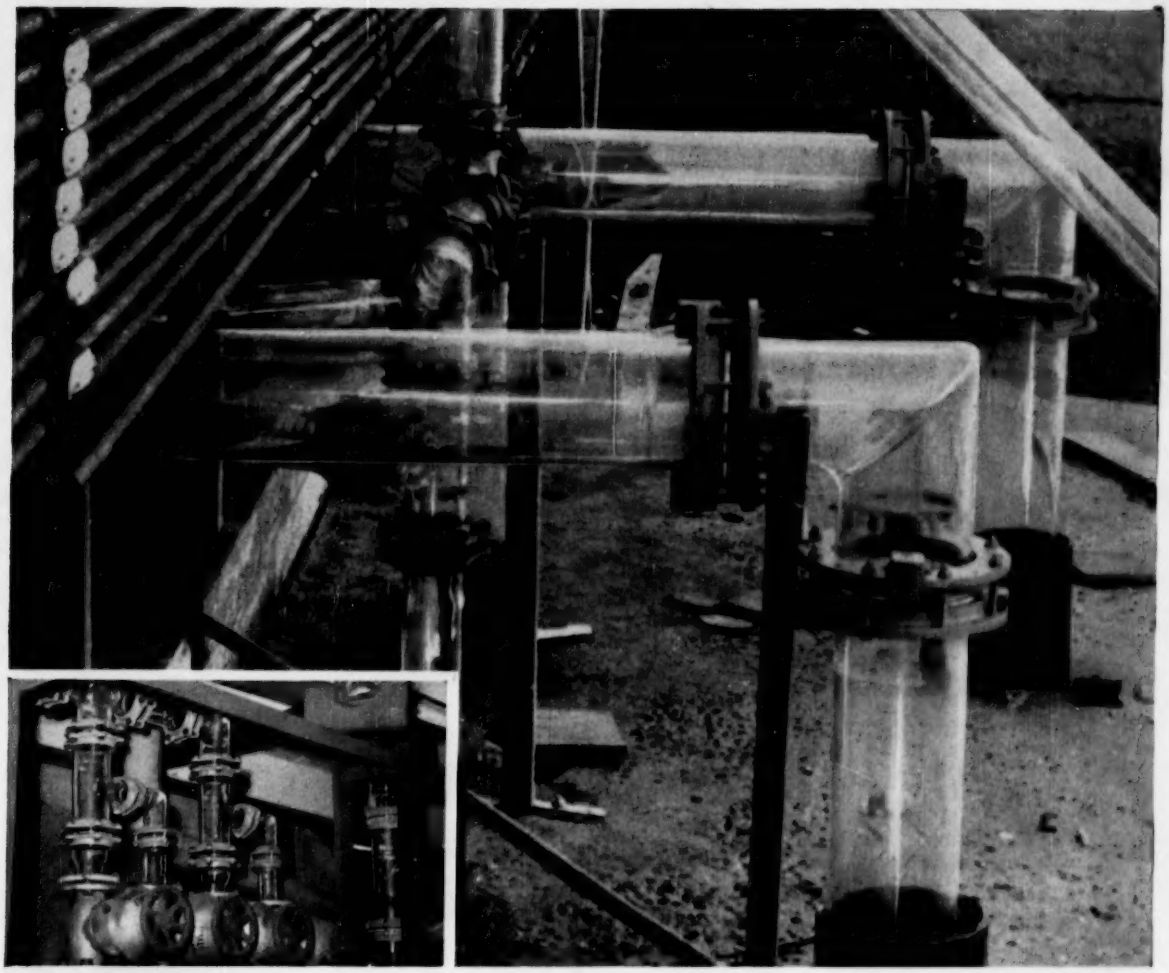
Not all the need is for precision instruments. Medicine, schools and industry need mass-produced, low-cost, thin-walled (for detecting faint activity) counters. In the hands of trained scientific personnel, these instruments can give radioisotopes the breakthrough they're looking for.

Chemical Industry's Postwar Growth Sparkles

If chemical processors needed final documentation of their achievements since World War II, they've got it now. The last proof came in the final figures of the U. S. Dept. of Commerce's 1954 Census of Manufacturers and 1955 Annual Survey of Manufacturers. The seven-year spread from 1947 (date of the last Census) to 1954 looks impressive enough. Add in the growth in 1955 and you've really got something.

	Value of Shipments (Million Dollars)			% Increase
	1947	1954	1955	'55/'47
Inorganic chemicals	**892**	**1,964**	**2,274**	**155**
Sulfuric acid	89	161	175	97
Sodium hydroxide	83	149	169	104
Sodium carbonate	63	109	111	76
Other alkalis	17	18	20	21
Chlorine	31	87	100	220
Ammonia & cpds., nitric acid	95	297	332	250
Other acids	30	79	95	215
Bleaching compounds	37	84	80	115
Aluminum compounds	77	235	256	235
Other potassium & sodium cpds	146	276	391	168
High purity chemicals	5	12	11	120
Organic chemicals	**3,013**	**6,101**	**7,653**	**154**
Cyclic (coal-tar) crudes	66	87	97	47
Intermediate coal-tar products	379	691	848	125
Plastic materials	552	1,463	1,839	235
Synthetic rubber	253	392	579	130
Synthetic fibers	678	1,202	1,437	112
Explosives	120	184	209	75
Drugs and medicines	**1,134**	**1,947**	**2,136**	**90**
Soap and glycerin	**957**	**481**	**500**	**−48**
Cleaning & polishing products	**351**	**998**	**1,083**	**210**
Paints & varnishes	**1,205**	**1,458**	**1,621**	**34**
Inorganic color pigments	**278**	**370**	**420**	**50**
Fertilizers	**468**	**855**	**859**	**84**
Vegetable & animal oils	**2,369**	**2,078**		**−12***
Carbon black	**76**	**95**	**121**	**60**
Compressed and liquefied gases	**110**	**195**	**226**	**105**
Insecticides & fungicides	**83**	**178**	**195**	**135**
Petroleum & coal products	**7,832**	**13,113**		**68***
Petroleum	6,792	11,865	12,953	76
Coke oven	1,040	1,248		20*
Rubber products	**2,644**	**3,579**	**4,408**	**68**
Stone, clay & glass products	**3,631**	**6,142**	**7,234**	**100**

*1954/1947



Chemical Mixing Manifold

Outside Vapor Lines

How glass pipe solves a mile-long corrosion problem

Champion Paper & Fibre Co., at its Canton, N. C. plant, was faced with a big corrosion problem . . . almost a mile long.

They are solving it with PYREX brand "Double-Tough" glass pipelines ranging in size from one to six inches in diameter . . . four thousand feet of it in 1955, more in 1956.

And it's really tough corrosion service — handling chlorine dioxide vapor and liquid solutions.

The chlorine dioxide is made by mixing sulphuric acid, sodium chlorate and sulphur dioxide. Residual acid is generally present, and recent developments indicate better quality chlorine dioxide is obtained by adding salt which could give a hydrochloric acid by-product.

Ease of handling and maintenance are also factors with Champion Paper. All of the pipe was installed by the company's own pipe fitters and welders.

If you have a problem involving corrosion in your plant—whether it's a five-foot drainline or a mile-long pipeline—call on your distributor of PYREX brand pipe. He'll be glad to help you. Write for his name and for more detailed information.

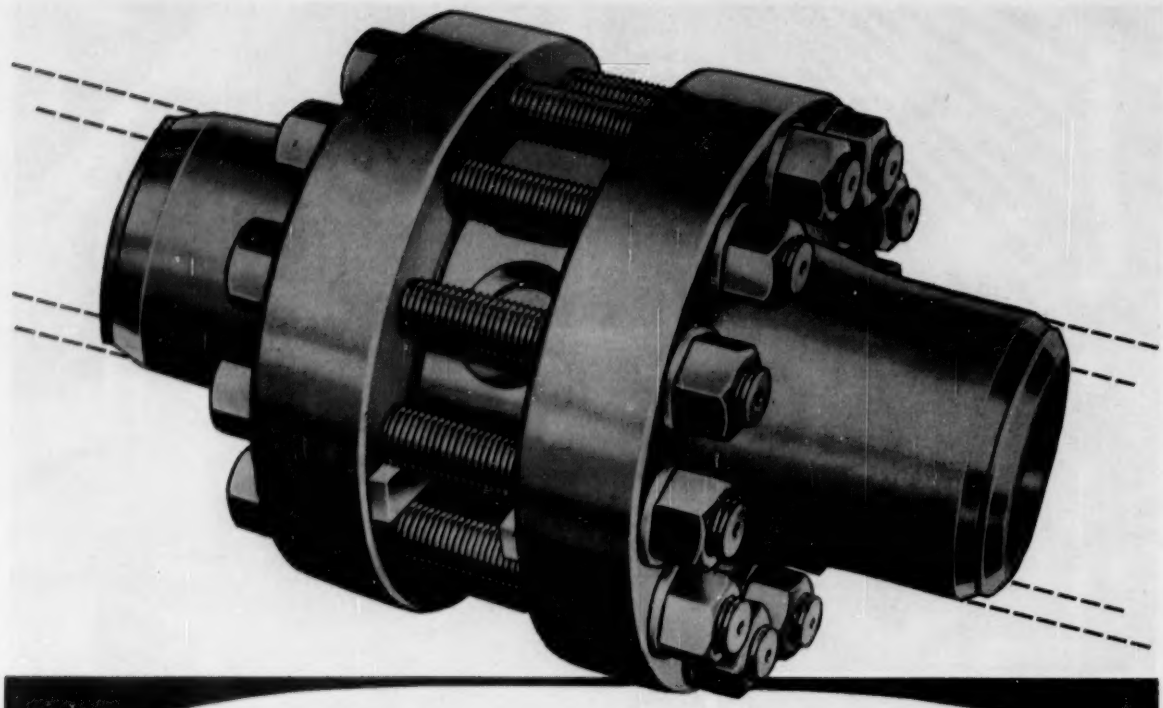
CORNING GLASS WORKS
110 Crystal Street, Corning, N. Y.

Please send me more detailed information on PYREX brand "Double-Tough" glass pipe ☐; send name of nearest PYREX pipe distributor ☐.

Name..... Title.....
Company.....
Street.....
City.....
Zone..... State.....

Corning means research in Glass

CORNING GLASS WORKS, 110 Crystal Street, Corning, N.Y.



Quickest Fix in Valves!

CHAPMAN 3-PIECE

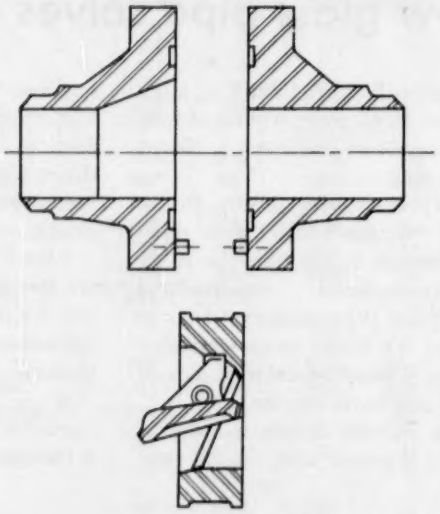
Tilting Disc Check Valve

When and if the time comes, it's as simple as this. You remove the studs between inlet and outlet section. You slip out the whole center . . . the working section . . . as a unit. You repair it or replace it and you have a valve as good as new in almost no time. It's the quickest, *lowest-cost* fix in valves.

Of course, with this 3-piece valve you get all the exclusive advantages of the Chapman 2-piece Tilting Disc Check Valve. You get fast, quiet operation. No flutter. No slamming. No banging. You get no scraping or wear and tear on disc or seat. You protect your whole valve system and keep your maintenance low.

If you don't have complete information on this and other Chapman Tilting Disc Check Valves, write for it, today. We'll get it into your hands, fast.

. . . just remove the center section



The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASS.



PUMP HOUSING is made precisely and accurately from REFRAX® silicon-nitride-bonded silicon carbide. It is used in handling chemical abrasive slurries where corrosion resistance is most important.

Refractories... to surpass **metals**

What material combines *all* the following properties? Corrosion resistance so that it is not wet by molten aluminum, and resists attack by most acids; abrasion resistance that prevents wear by both high velocity particles and sliding heavy masses; the ability to withstand temperatures to 3000° F; hot strength so high that at 2450° F its modulus of rupture is 5600 psi?

What material *combines* all these properties? Obviously not a metal, not even a cermet. It is one of Carborundum's special refractories – REFRAX® silicon-nitride-bonded silicon carbide. This material can be precisely formed to tolerances of ±0.005 in./in. with external and internal threads. Finish resembles that of a cast iron part.

Your high temperature problem, no matter how complex it may be, can almost certainly be solved with one of the scores of super refractories by Carborundum. For assistance, write for these three booklets:

CARBORUNDUM
Registered Trade Mark

MAIL THIS COUPON TODAY

Refractories Division,
The Carborundum Company, Perth Amboy, N. J., Dept. H107

Please send me:

- ☐ Current issue of Refractories magazine on REFRAX®
- ☐ Reprint of article in Product Engineering, Feb. '57 entitled "Nitride-bonded silicon-carbide bridges gap between metals and ceramics".
- ☐ Bulletin on REFRAX®

Name _____ Title _____

Company _____

Street _____

City _____ Zone _____ State _____

STAYNEW FILTERS

Dollinger makes ALL TYPES of filters as shown on this page, plus special filters for unusual filtration problems. New users of one specific type of Staynew filters often find a second Dollinger filter performs a great, added service in other processes or operations. Perhaps we can serve major or other filtration needs of your plant.

LIQUID FILTERS



Model HE (Sump) Liquid Filter Bulletin 330



Model ELS (Pressure) Liquid Filter Bulletin 300

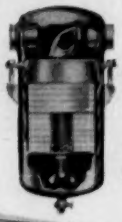
PIPE LINE FILTERS



Model CPH Pipe Line Filter Bulletin 200



Model CVH (Vacuum) Pipe Line Filter Bulletin 200



Model AAPHS (Absorption) Pipe Line Filter Bulletin 200



Model HPH and AHPH (High Pressure) Pipe Line Filter Bulletin 200

all types of FILTERS for every INDUSTRIAL NEED

AIR INTAKE FILTERS



Model IDR (Ground Level) Air Intake Filter Bulletin 100



Model DS (Silencer) Air Intake Filter Bulletin 100



Model D (Outdoor) Air Intake Filter Bulletin 100

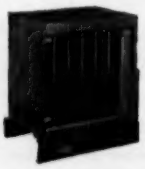


Model C (Indoor) Air Intake Filter Bulletin 100

VENTILATION FILTERS



Electro-Staynew Mist Collector Bulletin 420



Electro-Staynew Precipitator Bulletin 400



Automatic Ventilation Filter Bulletin 500



Dry and Viscous Panel Ventilation Filters Bulletins 600 and 700

GE PROTECTOMOTOR U.S. PAT. OFF.

Write, using Bulletin Numbers, for complete information on any of the Staynew filters illustrated. Consult Dollinger engineers on any special filtration problems—no obligation. Dept. 4 Centre Park, Rochester, New York.

STAYNEW **DOLLINGER**

FILTERS

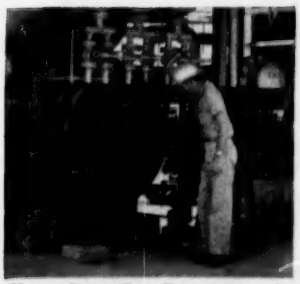
LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS



Interior of Kemp Generator in action

Burned up by inert gas costs?

Come to Kemp



Kemp Inert Gas Generator cuts inert cost 90% in Upjohn's Kalamazoo plant. Purity of gas is constant and exact qualitative analysis is maintained up to full generator capacity. Kemp generators play important roles in organic and inorganic operations throughout the country.

Kemp Inert Gas Generators end the trouble and expense of bottled gas, provide a highly flexible source of supply at a fraction of the cost. With Kemp generators in your operation, you can make liberal use of inerts . . . apply them to the improvement of many other operations. There are Kemp units to manufacture inerts in any quantity, for any application.

Kemp equipment is dependable. You get rugged design, simplicity of operation, and almost complete elimination of maintenance. Each unit is completely protected with safety devices. The heart of the generator is the famous Kemp Carburetor, for precise control of inert quality, regardless of system demands.

Kemp produced inerts belong in your plant . . . for blanketing, purging, and protective uses . . . agitation of batches during cooking . . . conveying combustibles and controlling reactions.



For new installations or modernization programs, call in your Kemp Representative. Or write us for Bulletin I-10. The C. M. Kemp Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.



Kemp Convection Dryers



Kemp Immersion Melting Pots

KEMP OF BALTIMORE



Kemp Industrial Carburetors



Kemp Oriad Dryers

REPUBLIC'S new family of

NULL-BALANCE-VECTOR* PNEUMATIC INSTRUMENTS



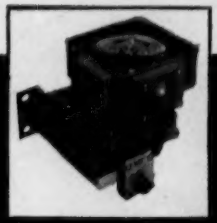
TYPE VP
Pressure Transmitter
Standard Ranges
0-1.5" to 0-5000 psi



TYPE VDP
Differential Transmitter
Standard Range
0-15 to 0-300" H_2O



TYPE VT
Temperature Transmitters
Standard Range
0-100° to 0-1000° F.



TYPE VC
Control Transmitters

* **Design principle which permits making extremely accurate and sensitive components that are compact, versatile and interchangeable.**

Republic's new line of pneumatic instruments includes pressure, differential pressure, temperature and control transmitters. Controllers that feature repeatable reset rate, less than 0.05% dead band and proportional band adjustment from 2 to 500%; —differential pressure transmitters with 20 to 1 range adjustment;—pressure transmitters of ±0.5% accuracy; and temperature transmitters with 10 to 1 range adjustment show the flexibility as well as the compactness, lightweight and accessibility of these instruments.

THE NULL-BALANCE-VECTOR PRINCIPLE

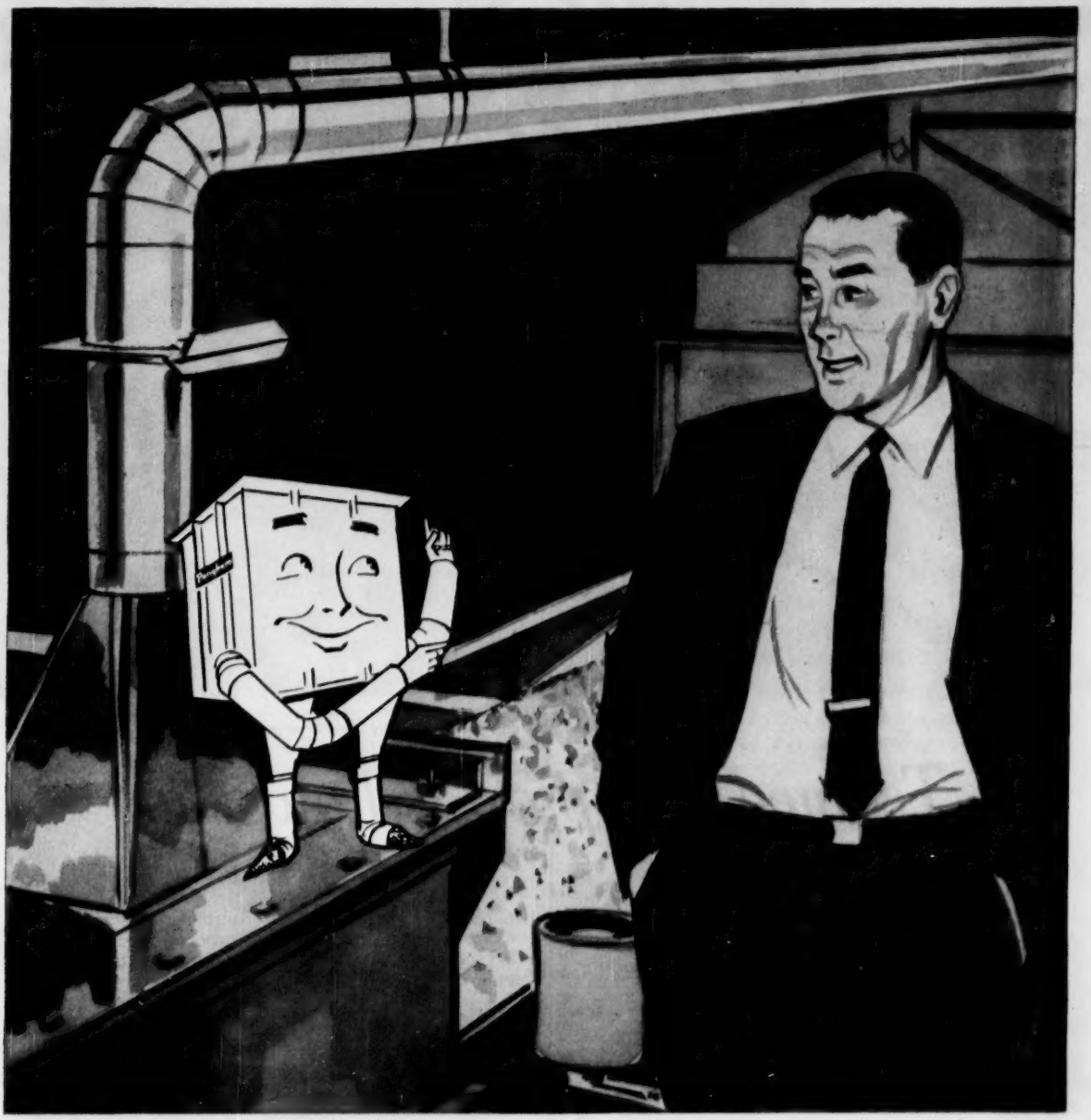
In terms of calibration, the null-balance-vector principle means that the span of any pneumatic instrument in the line can be varied at will . . . merely use a screwdriver and a reference . . . without re-setting zero. In terms of theory, the null-balance-vector principle means that the proportion of an input force (from a measuring bellows, bourdon tube, diaphragm, etc.) balanced by the pneumatic circuit can be varied by changing the angle at which that force acts on other links in the system. Hence, without changing air supply pressure or the measuring bellows, bourdon tube or diaphragm, the same output signal pressure range can reflect a measured input signal range that can be changed as much as 20-to-1.

Republic's new family of pneumatic instruments was developed in parallel programs that use the greatest possible number of common components. The result: High interchangeability of parts, even between instruments performing entirely different functions. Such design foresight has made the spare parts and training problems extremely simple. And Republic's null-balance-vector design means that full-range operation involves virtually no motion . . . and virtually no wear.

If you want the best sensitivity, accuracy and reliability in pneumatic transmitters, it would pay you to get full details on all four of Republic's new family of Null-Balance-Vector Pneumatic Instruments. Write for descriptive folios on each type, now.



REPUBLIC FLOW METERS CO.
A Subsidiary of Rockwell Manufacturing Company
2240 Diversey Parkway • Chicago 47, Illinois



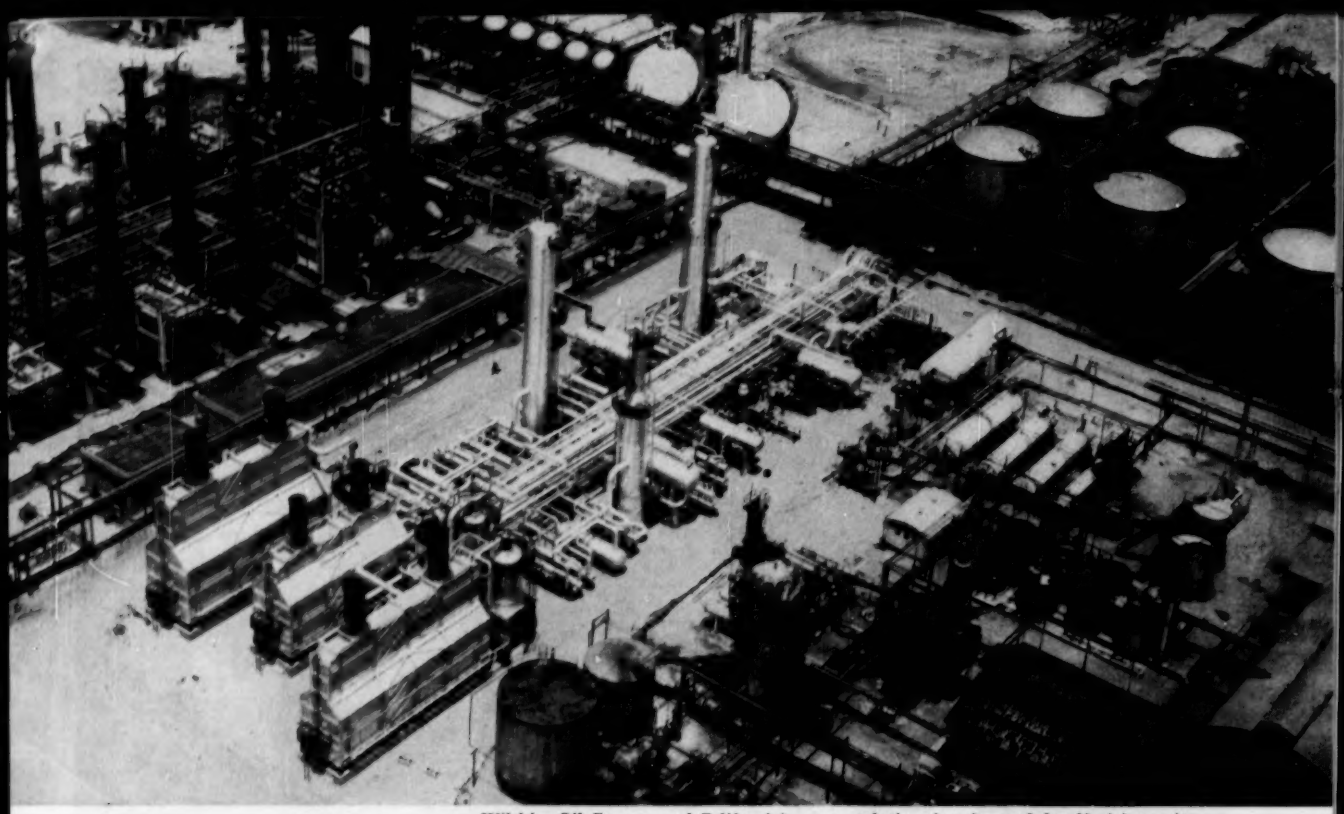
"What? A 15% increase in production machinery life?"

Yes, Pangborn Dust Control can increase your machinery life up to 15% or more! Pangborn Dust Collectors trap dust controlled at the source to prevent the abrasive wear and tear of uncontrolled dust settling in valuable equipment. Pangborn Dust Control can save you thousands of dollars by substantially lengthening the life expectancy of your machinery.

What's more, Pangborn gives you other benefits of lower housekeeping costs, higher employee efficiency, extra profits from any salvage value and better employee and community relations. And Pangborn offers a complete line of collectors, dry and *wet*, for all jobs.

Why not discover how you can profit from Pangborn Dust Control? Write for Bulletin 922 to: PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control & Blast Cleaning Equipment.*

Pangborn CONTROLS DUST



Wilshire Oil Company of California's new catalytic reforming and desulfurizing units at Norwalk, designed and constructed by SWECO to produce high-octane motor fuel.

Teamed to Upgrade Lowgrade

Working together, Wilshire Oil Co. of California and SWECO have been solving process problems since 1923. They've done it again with this new 10,000 BPD Platformer-Unifiner for premium-quality gasoline.

To help satisfy the growing thirst of modern auto engines for higher octane fuels, Wilshire Oil Co. of California decided to add a new catalytic reforming unit at its Norwalk plant. Design and construction were placed in the hands of SWECO's Engineering and Construction Division. A logical choice. The two companies have been working together since 1923, when SWECO built an absorption plant for Wilshire at Santa Fe Springs. And for 34 years, SWECO had been supplying Wilshire with heat exchangers and other process equipment. SWECO was a known *dependable* quantity.

High temperature, high pressure

The Norwalk project was a 10,000 BPD Platformer-Unifiner to upgrade low-octane naphthas. Temperature and pressure requirements were high: The Platformer – using platinum as a catalyst to reform the molecular structure of hydrocarbons–required 975°F., 650 psig. The Unifiner – freeing sulfur from the naphtha to permit high-severity reforming – required 675°F., 850 psig. To meet process requirements, SWECO supplied 13 heat exchangers, designed and manufactured at its Los Angeles plant.

Signed, sealed and "on stream"

Approximately 13 months after SWECO engineers went to work, the Norwalk unit went "on stream." (Total elapsed time included 7 months of field construction.) It's a typical SWECO job. Done right, and done right on time, whether it's in Tanganyika, the Andes, or around the corner in Norwalk, California.

Typical also of SWECO teamwork on all jobs . . . in *engineering and construction* of refineries, chemical plants and ore beneficiating mills . . . in the design and manufacture of *process equipment* . . . in a complete line of *vibrating screen separators* . . . or *extended service* in plant modernization; procurement and expediting; plant operation.

For more information on how SWECO teamwork may help your engineering and construction needs, write for Brochure E-5-32.

SWECO

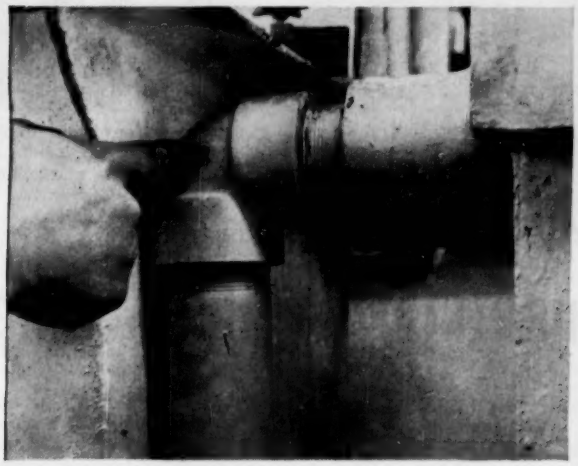
Southwestern Engineering Company

4800 Santa Fe Avenue, Los Angeles 58, California

Engineers and Constructors . . . Manufacturers

PVC PIPING NEWS

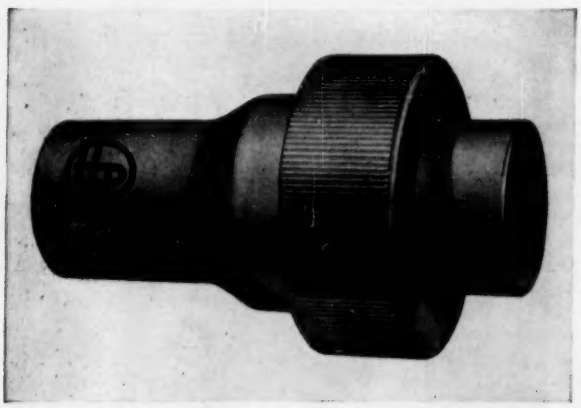
PUBLISHED BY TUBE TURNS PLASTICS, INC. • LOUISVILLE 11, KENTUCKY



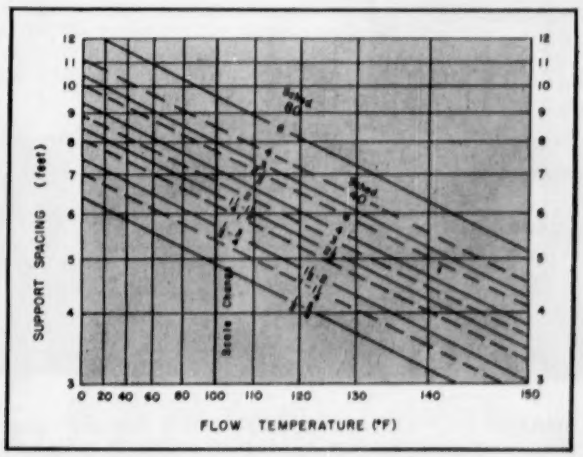
DRAIN LINES NOW PERMANENT. Former steel drain pipe and fittings on this pickle rinse tank oxidized quickly . . . lasted about a month. Replacement with PVC pipe and **ttp** fittings stopped this costly maintenance. Line is 2", schedule 80. Courtesy North Electric Company, Galion, Ohio. Contractor: Charles Hoffman Co., Mansfield, Ohio.



THE FULL LINE . . . NEARBY. Your Tube Turns Plastics' Distributor can deliver promptly from the complete line of **ttp** injection molded fittings, flanges, valves, solvent cement and thread lubricant. This one source can meet *all* of your requirements.



FIRST ALL PVC LIFT CHECK VALVE. Over 4 million cycles in 10% sulfuric acid solution and this valve still shows *no sign of wear!* Made of unplasticized PVC, it provides 100% flow area and may be installed in either vertical or horizontal position. Write for folder TTP 150.



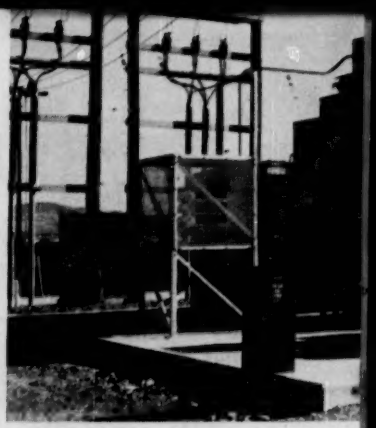
HOW TO SUPPORT PVC PIPE. This chart gives recommended support spacing for PVC pipe of different schedules and sizes. Full explanation of this procedure and other valuable application data are given in booklet TTP 119R, free on request.

Leading Manufacturer of Injection Molded Polyvinyl Chloride Pipe Fittings, Flanges and Valves

TUBE TURNS PLASTICS, INC.

Dept. P-9-A, 2929 Magazine St. • Louisville 11, Kentucky





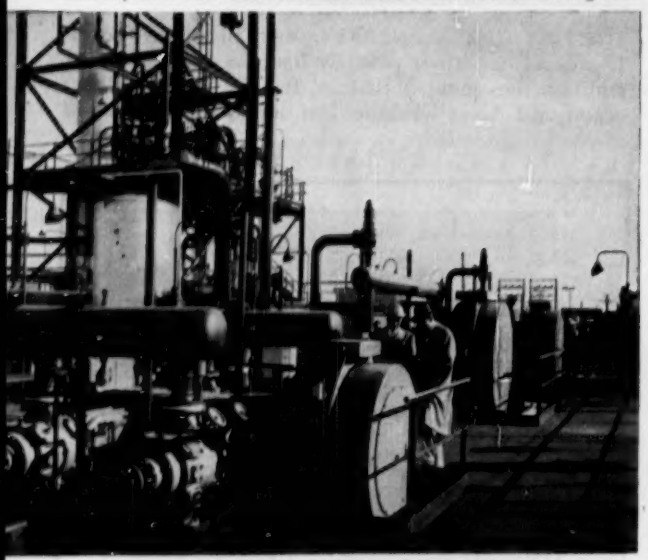
BUILT IN 14 MONTHS by The M. W. Kellogg Co., new ammonia plant is a unit of Standard's Richmond refinery, one of West's largest. All electric equipment is by General Electric, which also provided engineering service to help achieve fast start-up.

CO-ORDINATED for top reliability, G-E equipment in master substation for ammonia

At Standard's Richmond, Calif., refinery . . .

General Electric engineering services help

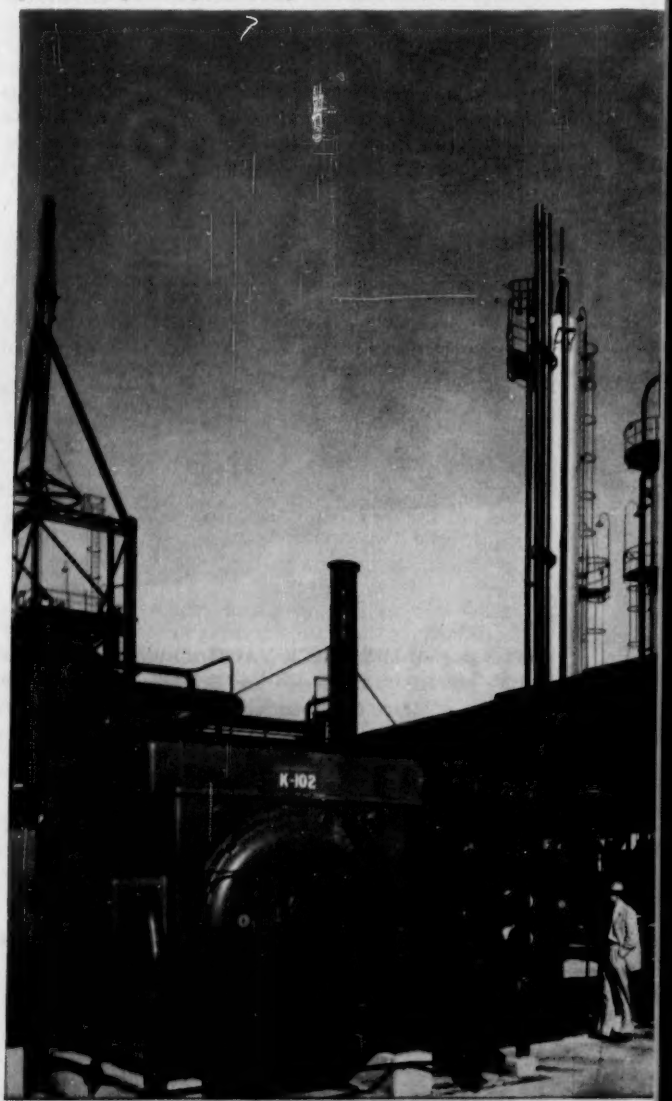
OUTDOOR-LOCATED on platform to drive compressors are 8 high-efficiency, enclosed, force-ventilated G-E synchronous motors (3 shown) with excitation obtained from substation's d-c m-g sets.

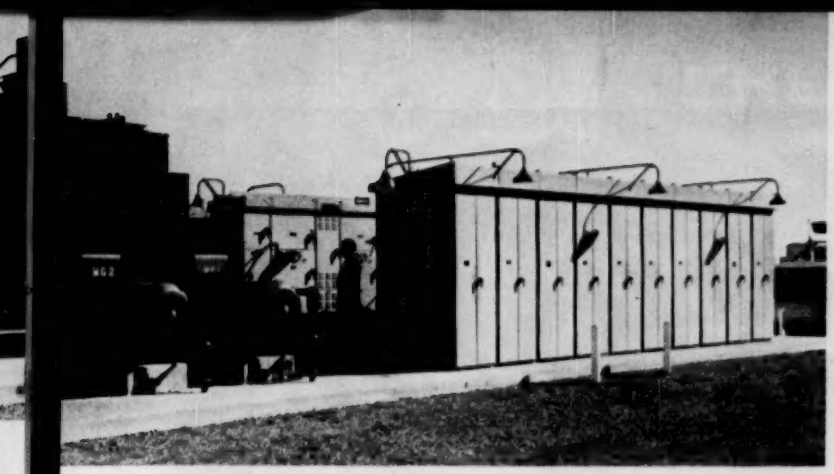


WEATHER-PROTECTED, 2 rugged 350-hp G-E induction motors drive cooling-water pumps. Other plant induction motors are either enclosed force-ventilated or explosion-proof, fan-cooled. ▼



PLANT'S BIGGEST, a 4000-hp 12,000-v totally enclosed force-ventilated G-E induction motor drives synthesis gas compressor. Explosion-proof 60-hp G-E motor (r.) drives blower





plant includes 5000-kva transformer, 17 units of 12-kv metal-clad switchgear, 2300-v Limitamp* motor starters, 480-v outdoor motor control centers, 2 outdoor motor-generator sets, and two 480-v transformers.

*Registered trade-mark of General Electric Co.



EASY MAINTENANCE of plant's G-E metal-clad switchgear is shown by workman removing vertical-lift, magne-blast circuit breaker for inspection.

speed opening of 300-ton/day ammonia plant

drawing clean air—via black ductwork and mushroom tower—from upper level of uncontaminated atmosphere.



General Electric power system, installed to meet rigid construction schedule, helps plant get fast start on profitable production

Standard Oil Company of California, Western Operations, Inc., recently added to its Richmond, California refinery—the largest west of the Rockies—a new $11 million ammonia plant designed, engineered and built by The M. W. Kellogg Co. The plant's capacity of approximately 300 tons per day of anhydrous and aqueous ammonia is shipped to nearby California Spray Chemical Corp., a subsidiary, for conversion into fertilizer.

GENERAL ELECTRIC supplied the new plant's electric equipment—compressor drives, auxiliary motors, and complete outdoor substation with co-ordinated components. In addition, General Electric engineering services helped both customer and designer get the new plant from the discussion stage to on-stream in only 14 months.

An example was the contribution of General Electric installation and field service engineers. By supervising the installation of the electric equipment as scheduled deliveries arrived, they helped reduce field installation costs, speed completion of construction schedules, and hasten start-up time. To Standard, this meant getting into production faster, and thereby, showing a return sooner on the large capital investment tied up in the plant.

IN ADDITION, the 17,000-kva block of power will be integrated into the existing plant system. General Electric application engineering services, working closely with Standard and Kellogg representatives, helped provide the electrical equipment co-ordination and integration necessary to meet the plant's process power requirements.

For *your* new chemical plant, too, General Electric offers a one-manufacturer source of quality electric equipment and valuable engineering services to help provide you and your process contractor with an efficient, co-ordinated electrical system. Early in your planning, contact your nearest General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 662-49

Engineered Electrical Systems for the Process Industries

GENERAL ELECTRIC

Other Fluoroflex®-T Products



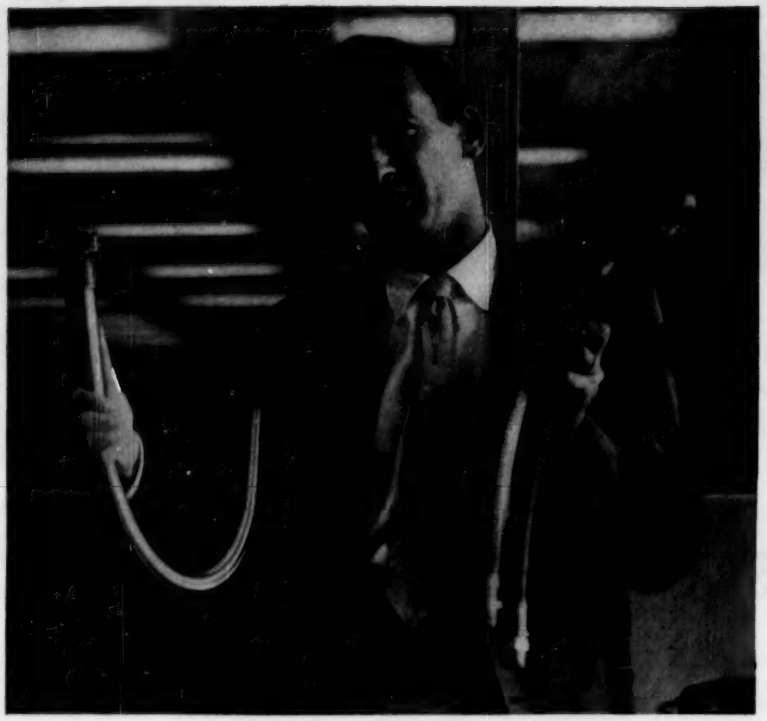
Laminated Dip Pipe: shatter and corrosion proof— withstands 500°F

A specially laminated construction gives this Fluoroflex-T Dip Pipe the strength and chemical inertness needed for the most severe applications.

Among the particularly desirable features of this dip pipe are its resiliency and light weight. Unlike those made from other materials, Fluoroflex-T Dip Pipe is fracture proof and immune to thermal shock. It cannot possibly damage glass lined and other types of expensive reactors.

Available in standard 2" to 3" ID. Special sizes to 6" ID fabricated. Send for data.

CAUTION: Because the properties of Teflon products can be varied widely by the fabricating methods employed, the fabricator's experience and integrity remain the user's best assurance of quality and performance.



The least expensive hose is the one you don't keep replacing

Here are three lengths of hose. Take the one on the far right. Subjected to hot oils at high temperatures — it soon deteriorates and fails. Result: time out for maintenance — and a requisition for a new hose.

Now consider the hose in the center. Installed on a severe flexing application . . . it readily fatigues and fails. Result: time out for maintenance — and a requisition for a new hose.

How often does this happen? Often enough to prove that "the *least* expensive hose is the one you don't keep replacing."

While Fluoroflex-T hose (on the far left) costs more initially, its performance actually results in real savings. Costly down-time, excessive maintenance (often at premium rates), product spoilage, interrupted production schedules, disappointed customers — all these are eliminated by Fluoroflex-T assemblies.

With its chemically inert patented tube and its blow-off proof fittings, Fluoroflex-T assemblies are ideally suited for conveying the most corrosive fluids — safely and economically. Write for data.



Most flexible hose problems are quickly solved for good with Fluoroflex-T hose assemblies — as proved by over three years of continuous service on the toughest applications in aircraft, missiles, rockets, and nuclear energy. Consider these qualifications: non-aging, completely inert chemically and flexible over range of —100°F to +500°F, exceptional flex life, lightweight, small O.D., 1000 psi pressures.

® Fluoroflex is a Resistoflex trademark, reg. U.S. Pat. off. ® Teflon is a DuPont trademark.

Originators of high temperature fluorocarbon hose assemblies

Resistoflex
CORPORATION

Roseland, New Jersey • Western Plant: Burbank, Calif. • Southwestern Plant: Dallas, Tex.



THE BIG NEWS

In Blends, Emulsions, Dispersions

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"Particle Control"

Look what Gaulin *Particle Control* can do for your product . . .

- Improve the texture, make a finer and more uniformly stable emulsion.
- Accent taste, scent and color. Lock in subtle flavors and fragrance against evaporation.
- Keep it always good to look at by stopping separation — no more "shake well before using"!

How about your product?

Chances are a Gaulin Homogenizer can help improve some food, beverage or chemical you make. Try this dramatic new approach to mixing and blending with a Laboratory Homogenizer for only $75.00 a month.

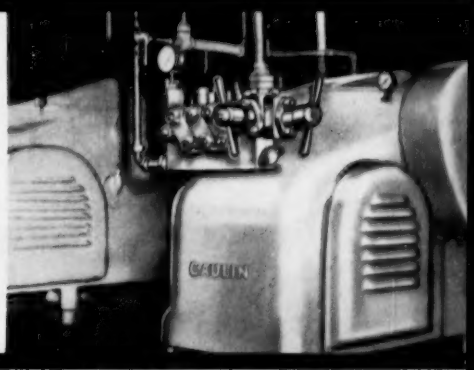


Laboratory Homogenizers Ask for Bulletin LH-55



New RE* Colloid Mills — Ask for Bulletin C-57

*Pat. Applied For



Homogenizers and Sub-Micron Dispersers Ask for Bulletins H-55 and SMD-55.



The G.T.A. Library of Product Information

Ask for G.T.A.—Gaulin Technical Assistance—for experienced advice and factual data on the best method to mix or move your product. Complete research and test facilities to help you. Write for FREE booklets to get you started. Manton-Gaulin Manufacturing Co., Inc., 71 Garden St., Everett 49, Mass.

Gaulin TRADE MARK

MANTON Gaulin MANUFACTURING CO. INC. EVERETT, MASS.

World's largest manufacturers of homogenizers, colloid mills and triplex high pressure pumps.

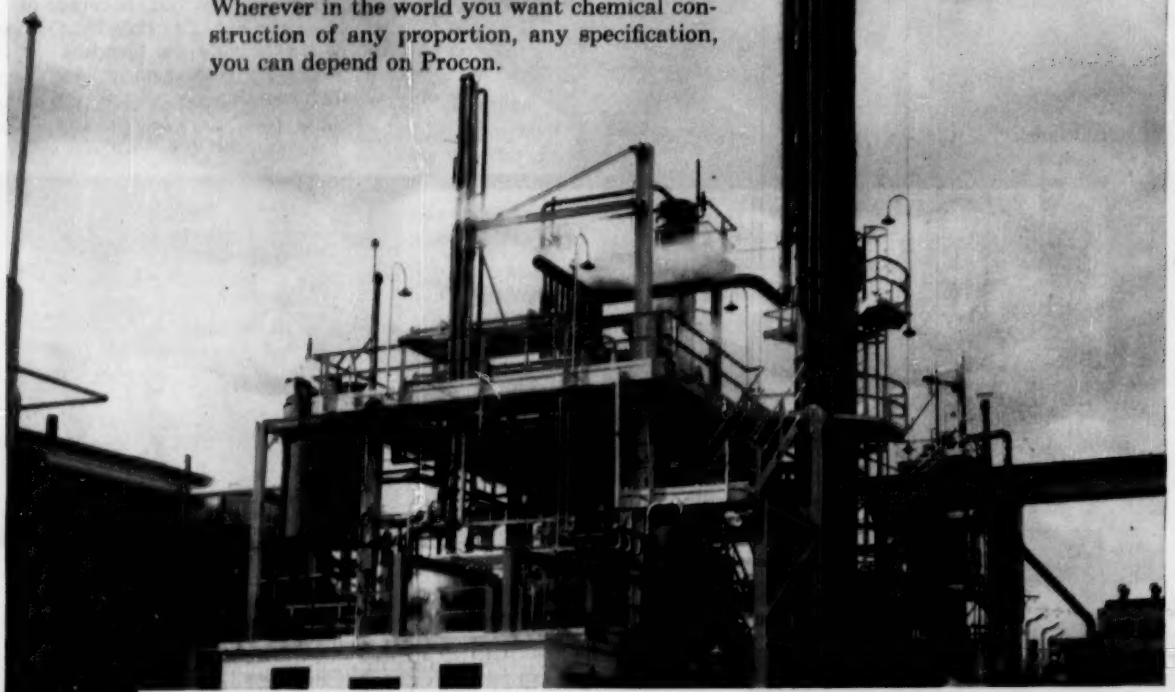
Near-Perfection Guaranteed... Perfection Delivered... By PROCON

New Sherwin-Williams Para C... Unit Delivers 100% Pure Prod...cts

Before Procon began construction of the Sherwin-Williams (Chicago) para cresol unit pictured here, we guaranteed unit performance that would produce product with no more than 0.2% ortho cresol in the bottoms or 2% para cresol in the tops. Procon did the job with such infinite exactness that the unit has produced product 100% free of ortho contamination in the para cresol or para contamination in the ortho cresol streams, as determined by infra-red spectroscopy.

Exacting as were the requirements of the job, the unit was designed, engineered and constructed in five months. Actual construction time, from barren site to completed unit, was only three months.

Wherever in the world you want chemical construction of any proportion, any specification, you can depend on Procon.



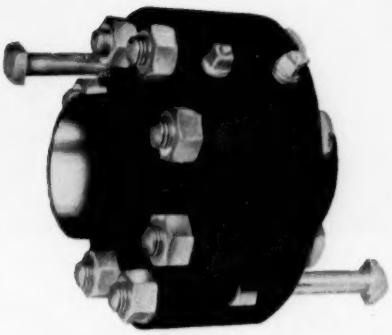
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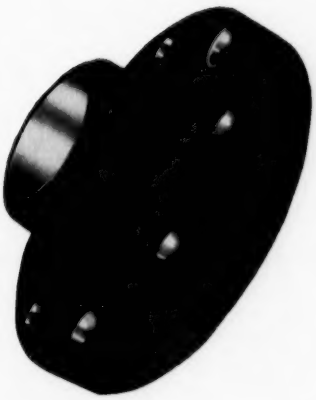






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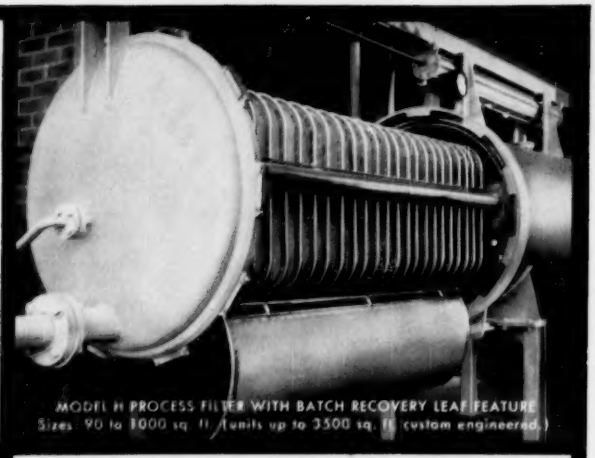
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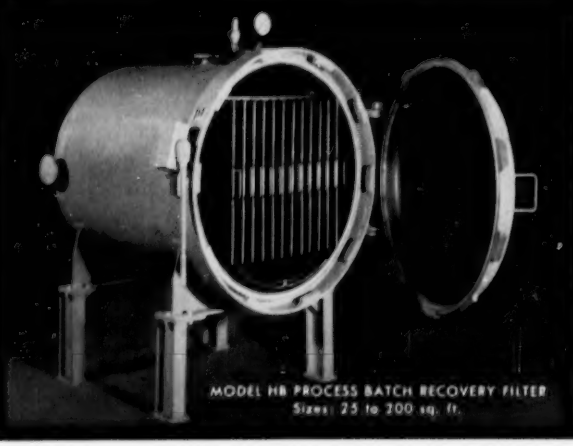
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when is a filter truly a batch filter?



MODEL H PROCESS FILTER WITH BATCH RECOVERY LEAF FEATURE
Sizes: 90 to 3000 sq. ft. (units up to 3500 sq. ft. custom engineered.)



MODEL HB PROCESS BATCH RECOVERY FILTER
Sizes: 25 to 200 sq. ft.

the PF answer:

when it filters
a complete preparation
down to the last drop!

That's exactly what these PF Filters are equipped to do. Especially designed for large and small batch filtering operations, they can be profitably utilized in continuous processes which involve a wide variety of liquid and solid separations. Processors who change products, formula and treatment will find that PF Batch Recovery Filters provide multiple advantages.

THERE'S NO WASTE — NO NEED FOR STORAGE! Featuring separately piped recovery leaves, PF Batch Filters are outfitted to handle unfiltered residue remaining in the tank at the end of the regular filtration cycle. The residue is filtered via blow-down rapidly down to practically the last drop in approximately the same time it would take to blow it back to a storage area . . . *and with less loss of residue.*

AND WHEN IT COMES TO PRODUCTIVITY . . . You can count on a PF Filter to boost your output in more ways than one. Start-up reports prove the point. For example: A 40 sq. ft. Process Model HB Filter clocked 1¾ hrs. in filtering a 2500 gallon batch — actually doing the job in less time than a 160 sq. ft. plate and frame filter. Residue remaining in the tank at the end of the regular filtration cycle was blown through the recovery leaf in five minutes. Cake discharge took 8 minutes.



LIKE MORE FACTS? Illustrated Bulletins, describing the Model HB and the Model H with Batch Recovery Leaf Feature, are yours for the asking. Write.

PROCESS FILTERS, INC. (A subsidiary of Bowser, Inc.)
1807 Elmwood Ave., Buffalo 7, N. Y.

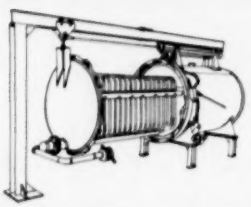
pf



VERTICAL LEAF FILTERS



VERTICAL BATCH FILTERS



HORIZONTAL LEAF FILTERS



CARTRIDGE FILTERS

Industry gets tons of oxygen
...with no capital investment

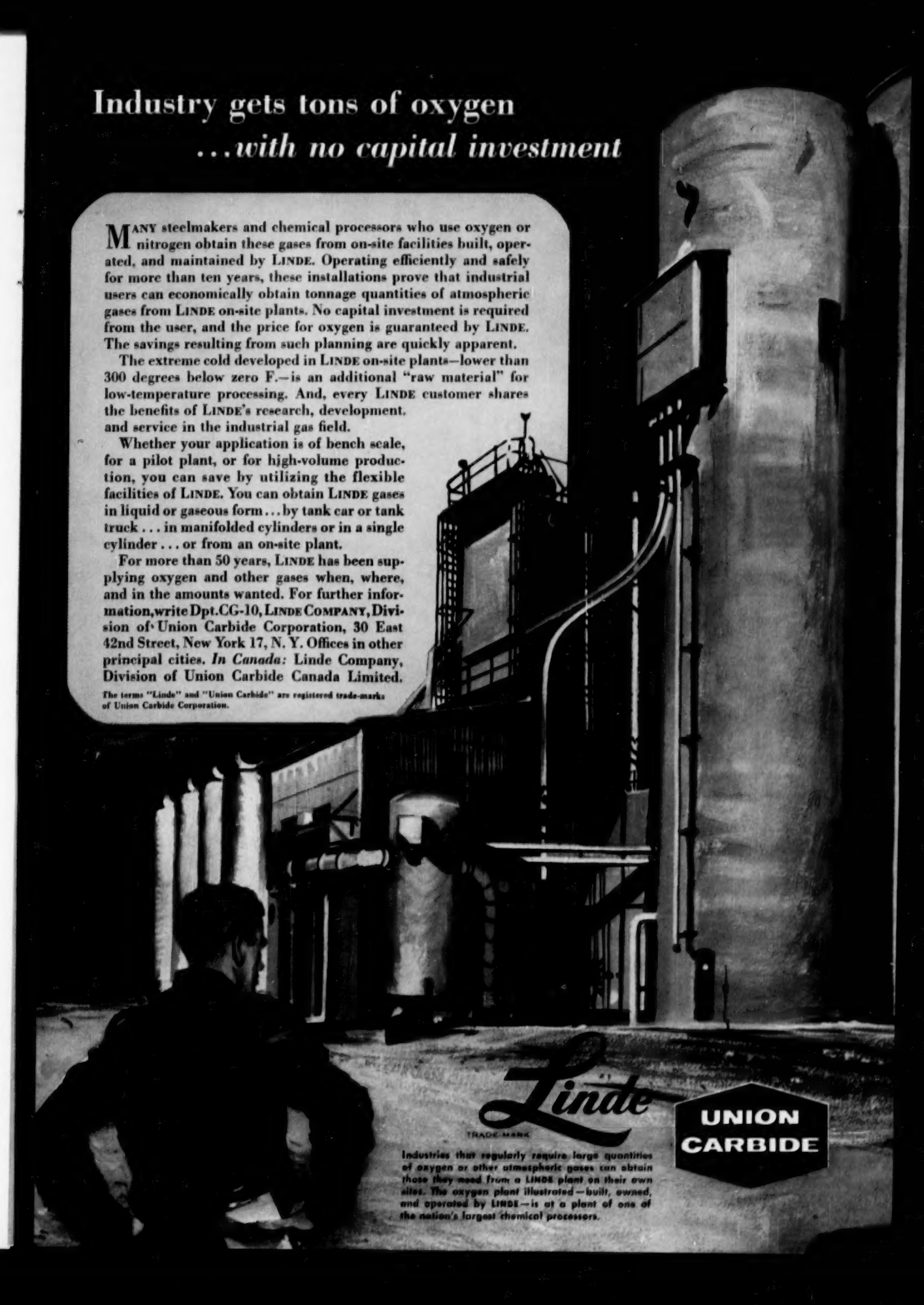
MANY steelmakers and chemical processors who use oxygen or nitrogen obtain these gases from on-site facilities built, operated, and maintained by LINDE. Operating efficiently and safely for more than ten years, these installations prove that industrial users can economically obtain tonnage quantities of atmospheric gases from LINDE on-site plants. No capital investment is required from the user, and the price for oxygen is guaranteed by LINDE. The savings resulting from such planning are quickly apparent.

The extreme cold developed in LINDE on-site plants—lower than 300 degrees below zero F.—is an additional "raw material" for low-temperature processing. And, every LINDE customer shares the benefits of LINDE's research, development, and service in the industrial gas field.

Whether your application is of bench scale, for a pilot plant, or for high-volume production, you can save by utilizing the flexible facilities of LINDE. You can obtain LINDE gases in liquid or gaseous form... by tank car or tank truck... in manifolded cylinders or in a single cylinder... or from an on-site plant.

For more than 50 years, LINDE has been supplying oxygen and other gases when, where, and in the amounts wanted. For further information, write Dpt. CG-10, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

The terms "Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.



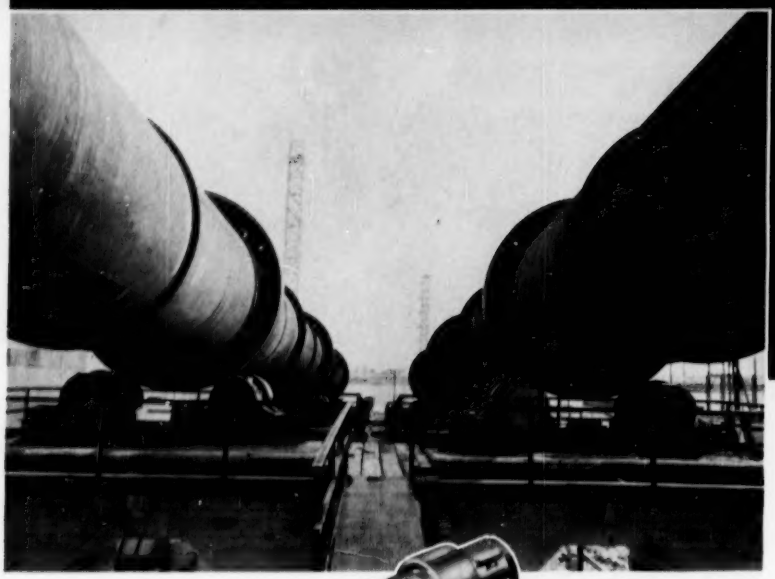
Linde
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UNION CARBIDE

Industries that regularly require large quantities of oxygen or other atmospheric gases can obtain those they need from a LINDE plant on their own sites. The oxygen plant illustrated—built, owned, and operated by LINDE—is at a plant of one of the nation's largest chemical processors.

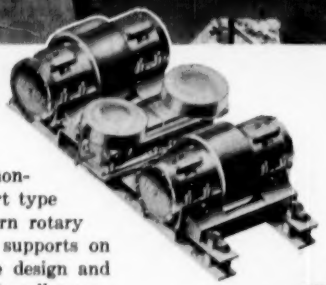
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is engineering leadership



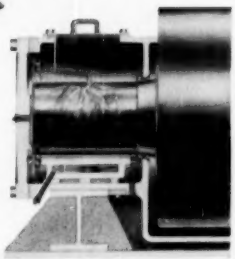
ROTARY KILN

Two 9'-6" dia. x 377'-0" Traylor Rotary Kilns in a Portland cement plant.



THRUST ROLLER MECHANISM WITH TWO BEARINGS SUPPORTING THE ROLLER TIED TOGETHER SO THAT A RIGID MOUNTING IS OBTAINED.

Leadership in engineering is demonstrated by the Traylor single support type roller bearings. Efficiency of modern rotary kilns depends largely on the roller supports on which they run. Traylor offers the design and perfection of the easy aligning, single roller supports, used on Traylor Rotary Kilns, Coolers, Dryers and Slakers. Traylor Engineers have over fifty years experience in rotary kiln design and manufacture—for more on Traylor-Made kilns write for bulletin No. 1115 today!



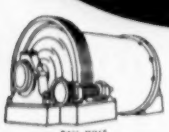
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APRON FEEDERS



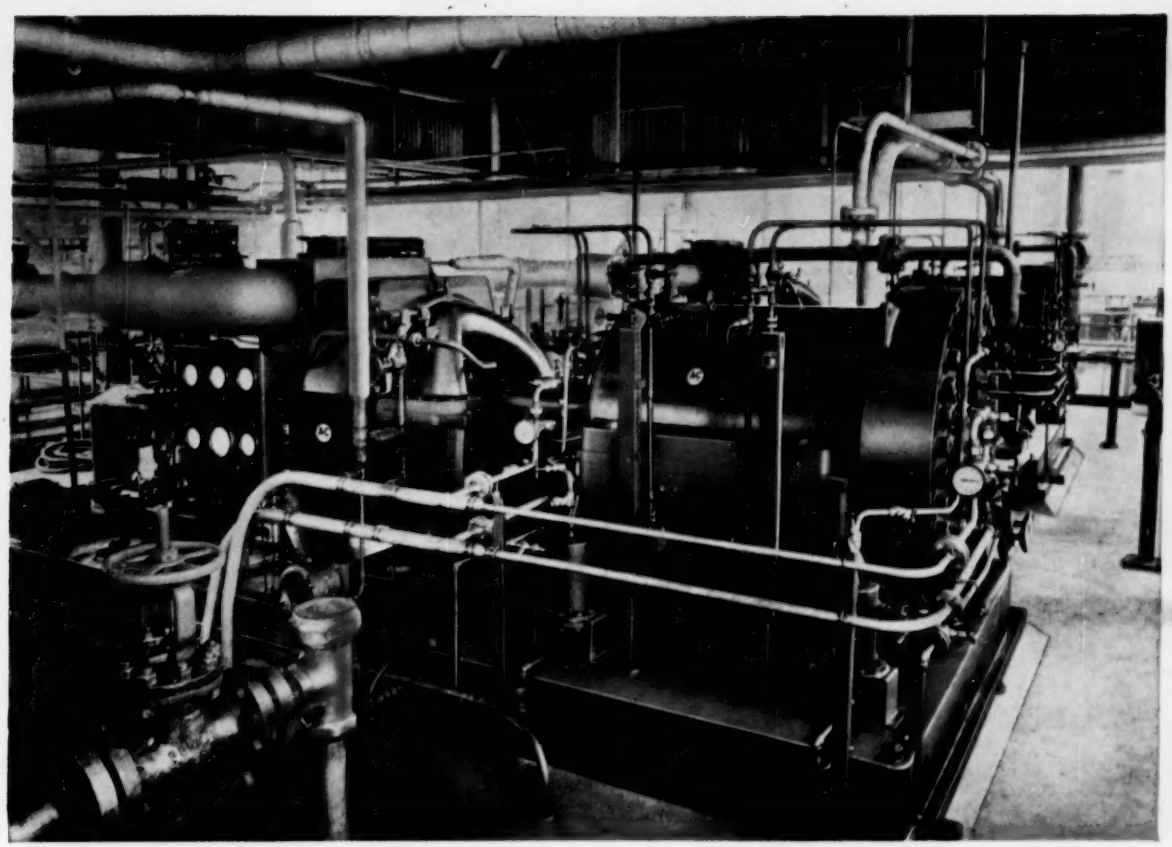
PRIMARY GYRATORY CRUSHERS



JAW CRUSHERS



SECONDARY GYRATORY CRUSHERS



Engineered and constructed by The M. W. Kellogg Company.

Gulf Refinery Uses Allis-Chalmers Compressors for Hydrogen Recycling

Two high pressure compressors of the latest Allis-Chalmers barrel-type design are in use at the Gulf Oil Corporation Plant at Port Arthur, Texas.

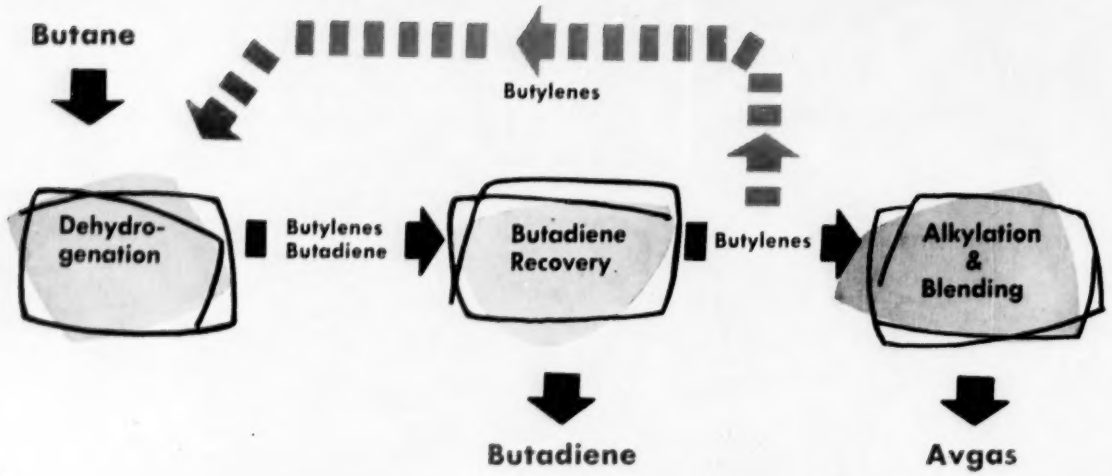
These units are used in a desulphurization process, in the refining of fuel oil. They are typical of Allis-Chalmers units chosen for upgrading processes.

Allis-Chalmers builds centrifugal, axial, and rotary sliding-vane type compressors for all refinery applications. Contact your nearby A-C office for information about your requirements, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5421

ALLIS-CHALMERS



Three-in-One Process Gets Butadiene and Avgas

UNIQUELY linking the three processes shown above —each with a solid commercial record of its own—into a single flowsheet, Texas Butadiene & Chemical Co. has come up with a strikingly flexible and attractively economical plant for the manufacture of both butadiene and high-octane gasoline from butane.

Brought to full capacity this June at Channelview, Tex., the new, $30-million installation, engineered and built by Fluor (Los Angeles), delivers 65,000 tons/yr. butadiene and 2.5 million bbl./yr. aviation grade gasoline. But, with only minor changes in operation, TB&C can shift output all the way to 86,000 tons/yr. butadiene and no avgas—or any product ratio in between.

"Thus," a company spokesman points out, "we can gear production specifically to the capriciousness of the marketplace." Furthermore, minor equipment and feedstock changes will convert the plant to isobutylene and isoprene along with the avgas.

▶ **Kickoff to Flexibility**—Of the three integrated processes—butane dehydrogenation to butadiene and butylenes licensed from Houdry Process, butadiene recovery via fractionation and furfural extractive distillation licensed from Phillips Chemical and sulfuric acid alkylation of butylenes jointly licensed from Texaco Development and Stratford Engineering—the first in line rates as the cornerstone of the plant.

A new development in its own right—to date only two outfits besides TB&C have it on stream*—this single-step catalytic dehydrogenation of butane hands the plant its versatility and accounts for a lion's share of its economies. Here's how.

* Standard Oil of California and Petro-Tex Chemical. Chemische Werke Huels, Firestone and Odessa Butadiene are building plants; Esso Research has just obtained a license. Sun Oil dismantled its plant.

Butane feeds over alumina-chromia catalyst and dehydrogenates at elevated temperature (1,150 F.) and slight vacuum (3.5 psia.) to produce a gas mixture consisting chiefly of butadiene, butylenes and unreacted butane.

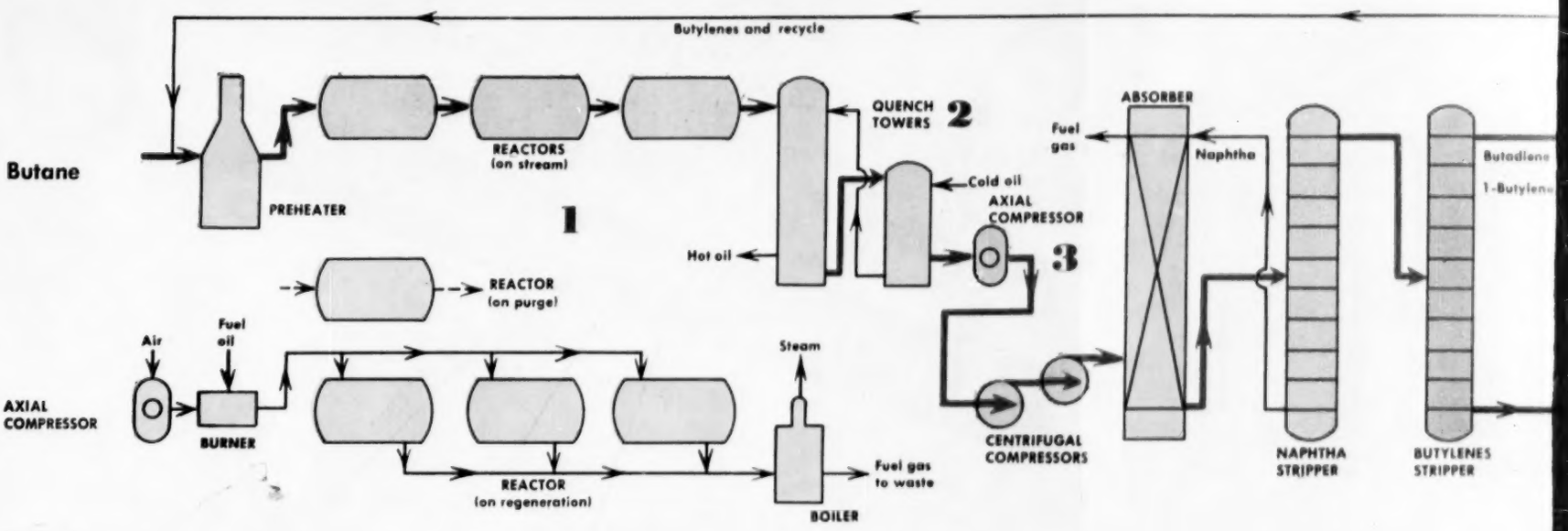
Depending on the product ratio that it wants, TB&C can vary the amount of butadiene produced by varying the pressure of the dehydrogenation. Higher pressures produce more butylenes. It further controls what it makes by what it does with the butylenes and butane, separated out in the butadiene recovery stage. For, it can recycle them back to the dehydrogenation reactors and make more butadiene. Or it can pipe them to the alkylation stage to make alkylate for blending with isopentane and tetraethyl lead into gasoline; or a little of both.

▶ **Scores Economies**—And here's where the Houdry butadiene route scores its savings.

Using readily available and relatively inexpensive normal butane as charge stock, process sidesteps need for the costly feeds (e.g., butylene, ethyl alcohol, acetylene) common to most butadiene routes. And butane feed further means that elaborate feed preparation isn't required.

Too, dehydrogenation reactors use refractory linings, so eliminate costly alloy construction. And charge enters reactors at reaction temperature to minimize premature cracking and insure high product yields and purities. Further, by running the reaction in a narrow temperature range (about 50 F.), TB&C extends catalyst life. And by regenerating catalysts with fresh air, it beats need of recirculating hot flue gas.

▶ **Other Engineering Touches** — Moreover, plant's highly instrumented for maximum automation, safety and product quality control. Entire installation needs



only 17 operators/shift. And instrumentation, it's estimated, boosted plant capacity 15%.

A master electrical timer controls the dehydrogentor valves for on-stream, catalyst regeneration and reactor purge cycles. An on-stream system of ultraviolet, infrared and vapor fractometer analyzers, developed by Phillips, monitors the butadiene recovery operation.

Other standout features: A central hydraulic power system actuates reactor valves. This provides quick operation and positive movement of valves ranging in size from 3 to 30 in. And, for the first time in a major process plant, axial compressors are used. They offer greater capacity, higher efficiency, smaller size and less weight than centrifugal machines.

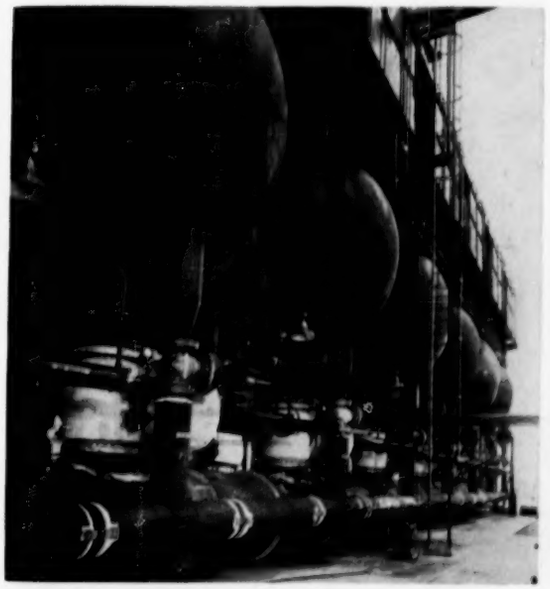
▶ **How Process Works**—Fresh normal butane (370,000 gal./day) and recycle butylenes and butane are mixed to produce a feed analyzing about 27% butylenes and 73% butane. Stream splits to feed two parallel-hooked dehydrogenation process trains. Vaporized against a hot quench oil, each stream is brought to 1,150 F. in a Petrochem heater before flowing to the dehydrogentors.

Each reactor train consists of seven, series-hooked, horizontally placed steel drums, 20 ft. long by 14 ft. dia. Reactors are ceramic-tile lined to prevent iron contamination of the reaction. Each unit holds a 3-ft.-deep catalyst bed of pelleted alumina impregnated with 18-20% chromic oxide. Tabular alumina, catalytically inert and with high heat capacity, is also mixed through the bed as a means of storing heat.

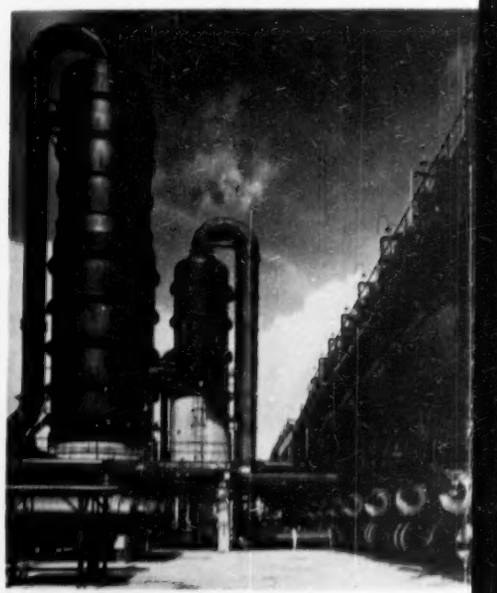
At any given moment, three reactors are on stream, three on regeneration and one on various purge and valve switching cycles. Each reactor is on stream 9 min.; then it's purged to remove hydrocarbons and switched (time: three min.) to a 9-min. regeneration cycle.

Excess regeneration air is compressed to 28 psia. by five-stage, 9,600-hp., 174,000-cfm. axial compressors, one for each reactor. Air is preheated by direct combustion with fuel gas, then flows through the catalyst bed to burn off coke deposited during dehydrogenation. Alumina chips store regeneration heat and hot flue gas goes to a waste heat boiler to produce 250-psi. steam. Then reactor switches back on stream.

▶ **Dehydrogenation**—Feed vapor takes stored heat out of catalyst bed and dehydrogenates, at 1,150 F. and 3.5 psia., to produce an effluent gas stream analyzing 10% butadiene, 40% butylenes and 43% butane. To prevent polymerization of butadiene, this stream is immediately cooled to 110 F. via direct contact with an aromatic oil in two quench towers.



1 **REACTORS: Butane dehydrogenates at 1,150 F. to butadiene, butylenes over chromia-alumina catalyst.**

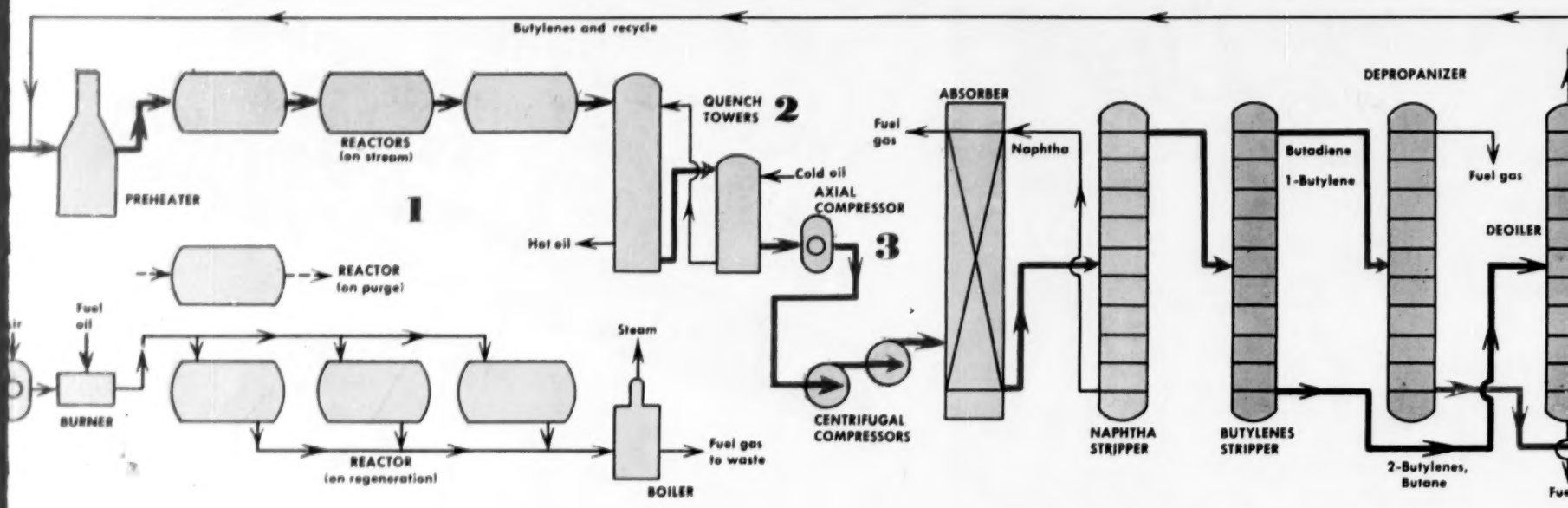


2 **QUENCH TOWERS: Direct contact with stream to 100 F., prevents butadiene polyme**

Gases are compressed to 160 psia. in three, hooked compressors. First machine is an 174,000-cfm., 3,650-hp. axial compressor; se 5-stage, 3,690-hp. centrifugal and third, a 2,000-hp. centrifugal compressor.

At this point, the two parallel compress streams rejoin and pass through a light absorber-stripper system to cut out light e and lighter). Then the mixed stream, now li 100 F., goes to the butadiene recovery system

▶ **Butadiene Recovery**—Here again the str



perators/shift. And instrumentation, it's boosted plant capacity 15%.

r electrical timer controls the dehydro- es for on-stream, catalyst regeneration and rge cycles. An on-stream system of ultra- ared and vapor fractometer analyzers, de- Phillips, monitors the butadiene recovery

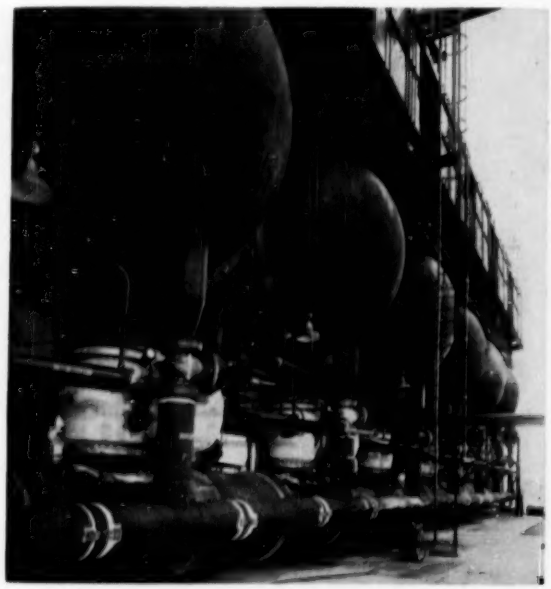
andout features: A central hydraulic power uates reactor valves. This provides quick and positive movement of valves ranging m 3 to 30 in. And, for the first time in a ess plant, axial compressors are used. They er capacity, higher efficiency, smaller size eight than centrifugal machines.

ocess Works—Fresh normal butane (370,- ay) and recycle butylenes and butane are roduce a feed analyzing about 27% butyl- 73% butane. Stream splits to feed two ked dehydrogenation process trains. Va- gainst a hot quench oil, each stream is 1,150 F. in a Petrochem heater before the dehydrogentors.

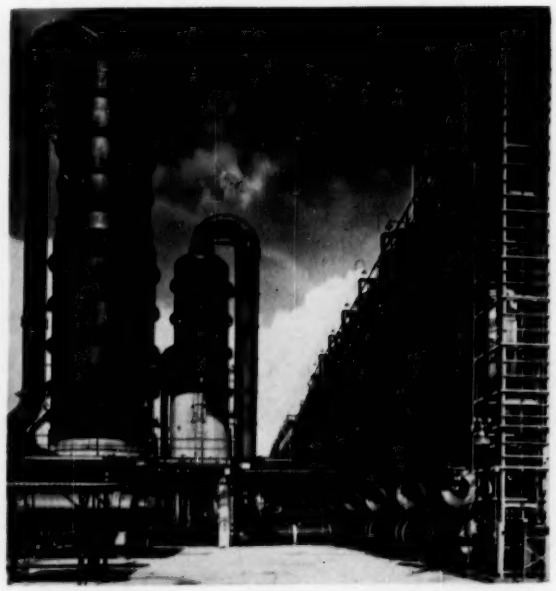
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2 QUENCH TOWERS: Direct contact with oil cools stream to 100 F., prevents butadiene polymerization.



3 AXIAL is first o

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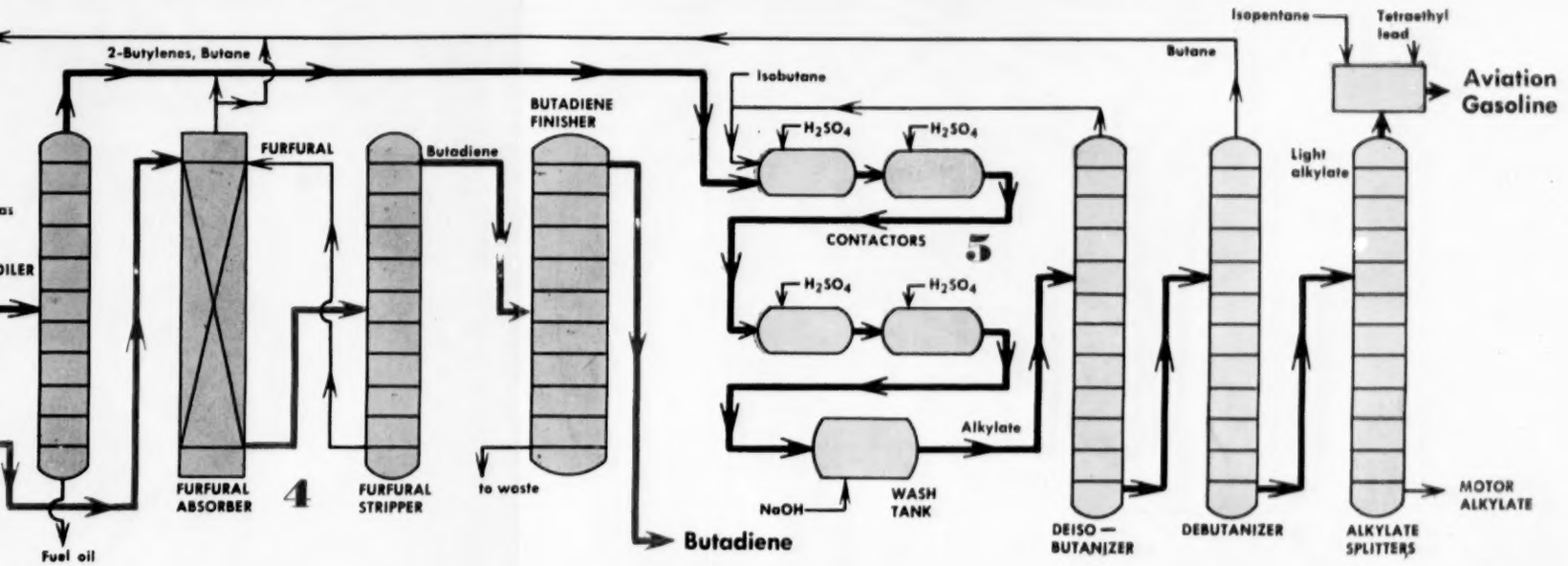
Gases are compressed to 160 psia. in three, series-hooked compressors. First machine is an 11-stage, 174,000-cfm., 3,650-hp. axial compressor; second, a 5-stage, 3,690-hp. centrifugal and third, a 3-stage, 2,000-hp. centrifugal compressor.

At this point, the two parallel compressed gas streams rejoin and pass through a light naphtha absorber-stripper system to cut out light ends (C_4 and lighter). Then the mixed stream, now liquid at 100 F., goes to the butadiene recovery system.

▶ **Butadiene Recovery**—Here again the stream di-

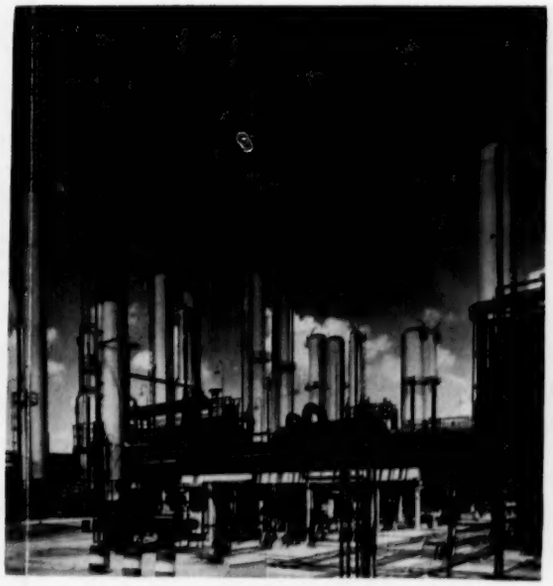
vides to fee stream passes cap distillatio ers split out and a butane

Bottoms st deoiled and e pipe on to a then feed to t cuits. Butadi tall, Raschig-

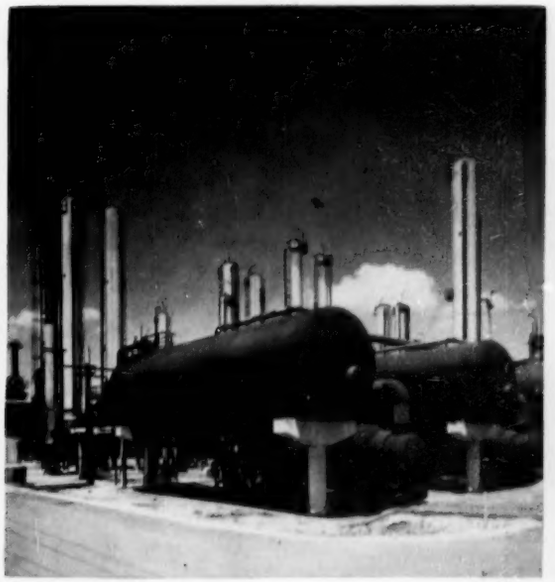




XIAL COMPRESSOR: This 11-stage, 3,650-hp. unit first of three that compress stream to 160 psia.



4 BUTADIENE RECOVERY: Fractionation and furfural extraction distillation split butadiene.



5 ALKYLATION: Butylenes are alkylated with isobutane over H_2SO_4, then blend with isopentane, TEL.

o feed two parallel process trains. Each passes to two, 200-ft.-tall by 14-ft.-dia. bubble tillation columns operating at 165 psia. Tow- it out a butadiene and 1-butylene overhead butane and 2-butylene bottoms.

ms stream from both trains combine, are and either recycle to the dehydrogenators or to alkylation. Overheads are depropanized, ed to twin furfural extractive distillation cir- Butadiene is absorbed by furfural in a 125-ft.- schig-ring-packed absorption tower operating at 85 psia. Overhead from these towers cycle to the dehydrogenators and/or on to the alkylation area.

Furfural is stripped from the butadiene in two distillation columns operating at 70 psia. Furfural recycles to the absorber and butadiene, 90-95% strong, enters a 100-ft.-high by 10-ft.-dia, distillation column operating at 85 psia. that gives a 98% butadiene product for market.

► **Alkylation** — Butylenes and butane destined for avgas are reacted with isobutane (180,000 gal./day) in the presence of 98% sulfuric acid in 4, series-hooked alkylation contactors. These units are equipped with effluent refrigerations systems, developed by Stratford Engineering. Reaction runs at 40 F. and 70 psia.

Mixture of excess isobutane and alkylates from last contactor is caustic washed and charged through a fractionation system. It's deisobutanized and debutanized. A light alkylate is then split out to be blended with isopentane (65,000 gal./day) and tetraethyl-lead to make 115/145 aviation grade gasoline. TB&C also produces a motor alkylate for market.



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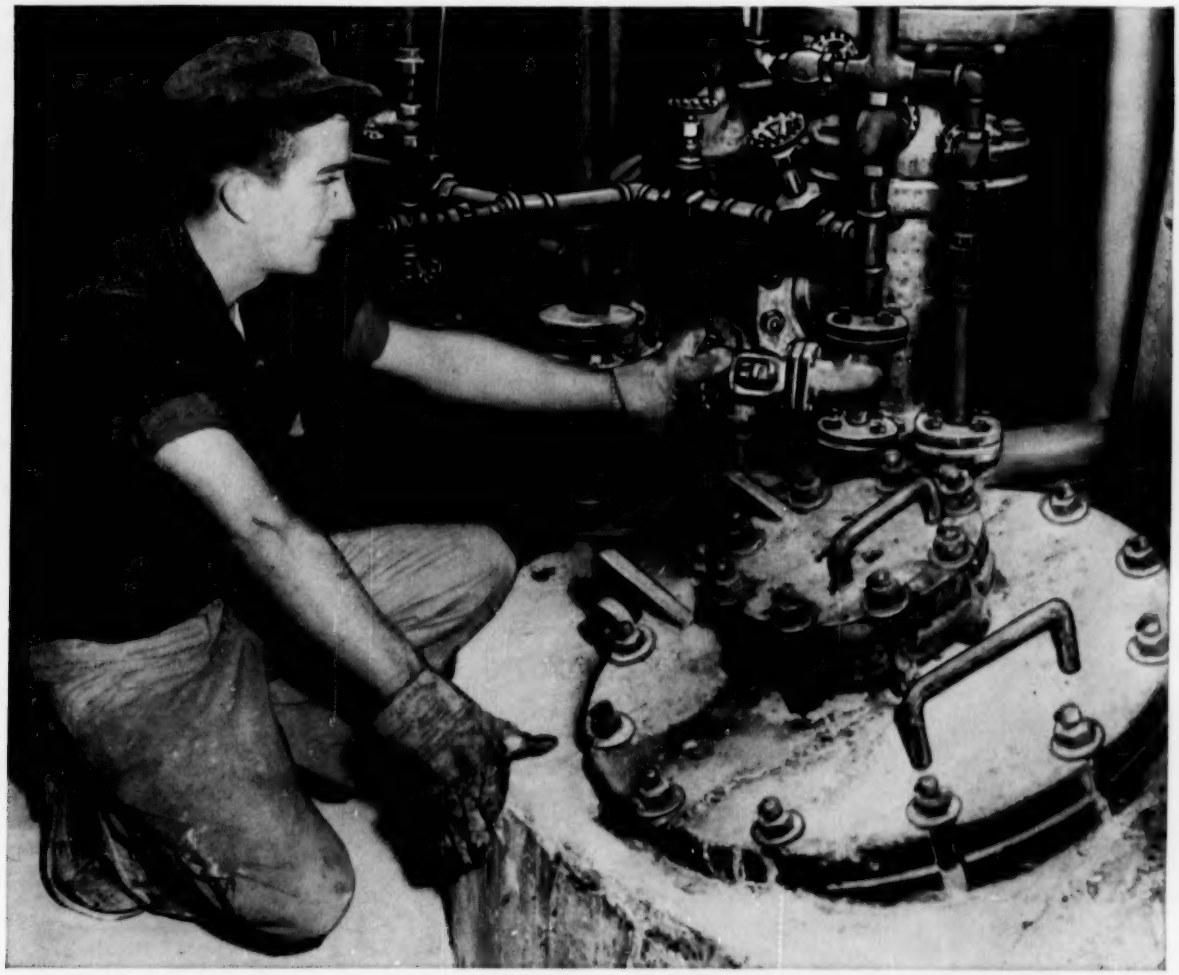
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How Crane quality pays off at Crosby Chemicals, Inc.



These valves resist corrosion from hot fatty acid

In reading this case history from Crosby Chemicals, Inc., Picayune, Miss., you'll recognize why Crane quality pays off again and again by cutting maintenance costs.

The valves you see here are Crane 1-inch No. 18845 stainless steel gates installed on the heat control line to a resin retort. They are subjected to corrosive effects of hot fatty acids as well as resin fumes. Valve operation is frequent—whenever heat control is required and every time batches are changed.

Despite over a year of this severe service, these Crane valves haven't needed a nickel's worth of maintenance. The owner reports no galling, no seizing, no leakage, no evidence of corrosion. Although not ordinarily recommended for steam applications, these Crane 18-8 SMo valves are holding up on this rugged, high-temperature service because their unique split-wedge disc construction permits: (1) free disc rotation with precision guidance, and (2) gives uniform distribution of seating loads. Together, these features avoid galling of seating surfaces, reduce wear, and assure smooth, easy operation under all conditions.



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Chemical Engineering

Practice

Flexible flowsheet gets butadiene, avgas TURN BACK TO P. **224**

Butane charges to unique, three-part process—dehydrogenation, extractive distillation, alkylation.

Fight rising costs with modern control systems **233**

Forecast, control and reduce your processing costs by using today's cost accounting methods.

Successful solids pipeline now on stream **249**

For their new plant, American Gilsonite pioncered in designing a pipeline for solids. Here's how it works.

Save and use these design references **255**

On materials of construction, corrosion, paints, coatings and physical data—to help you with knotty problems.

Plants for chemicals from petroleum **263**

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Practical operating tips that help you plan efficient and complete inspection and repairs to Dowtherm vaporizers.

These methods give heat capacities fast **283**

This article shows how you can get quick estimates for natural gas, petroleum and hydrocarbon vapors.

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Use these basic data and you'll do a better job of predicting what will happen and when it'll happen.

How's your math? **296**

In today's chemical processing your grasp of mathematical tools is vital. This series will help you brush up.

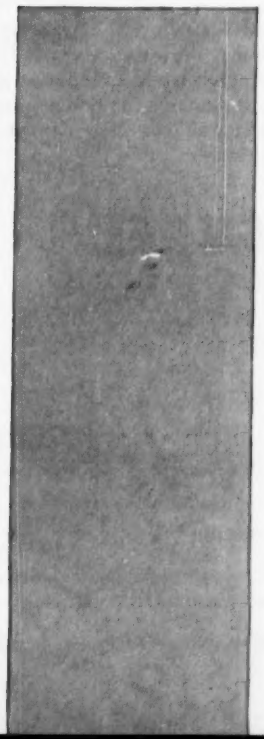
What about aluminum for heat exchangers? **318**

You can now take your pick from a host of improved alloys now available. Here are the details.

OCTOBER 1957

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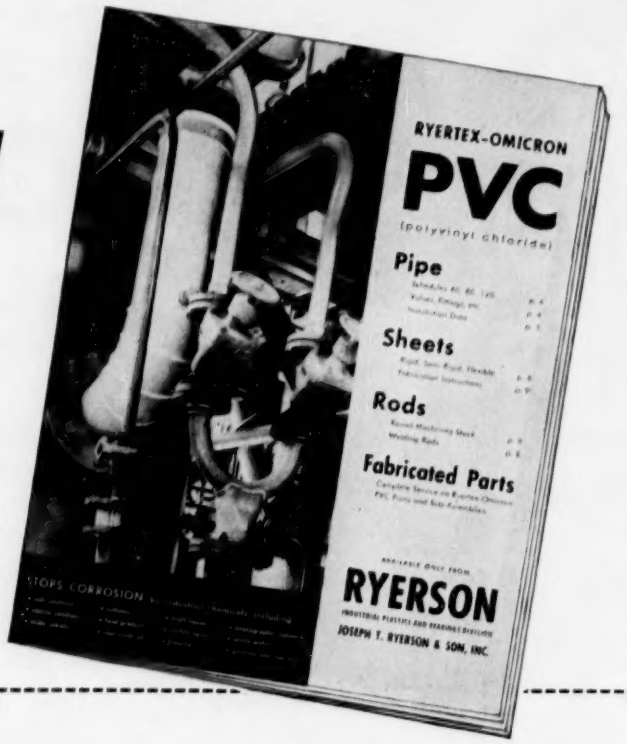
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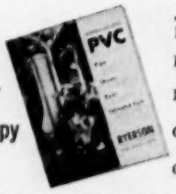
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A CHEMICAL ENGINEERING REPORT

HOW TO BUILD PROCESS

Cost Control Systems

FOR CHEMICAL OPERATIONS OF ALL TYPES

Reduce costs and increase profits
Maintain a set cost level for process operations
Forecast with more accurate cost information
Establish new product prices with confidence
Determine when to replace equipment more exactly
Decide when to decentralize from accurate data
Evaluate personnel on basis of cost performance

E. B. NITCHIE, Ernst & Ernst, New York, N. Y.*

FAST rate of growth marks the chemical process industries as progressive and forward looking.

They have depended to a large degree on chemical engineering techniques to work out economical, high yield processes.

To reduce processing costs, chemical engineers have concentrated in the past on the engineering approach. But at the same time a host of other routes to low cost operations have been developed in recent years, which chemical engineers and the process industries have been slow to adapt. In many cases the new techniques have developed outside the normal areas of chemical engineering.

Even the best processes now come up against stiff competition. It becomes of paramount importance to use all of the available means of reducing and controlling costs. We must as chemical engineers and managers be equipped with at least the important tools in the process control kit.

The chemical engineer greatly adds to his value by knowing some of the skills of cost accounting, industrial engineering and the other techniques of management as applied to his industry.

One of our largest chemical companies experimented recently with training its chemical engineers in cost accounting. The main objective was better cost estimating for new processes, but perhaps the more important byproduct turned out to be better engineering information for cost reduction.

This is not to say that the proc-

* Meet your author on page 346.

How Cost Data Help Make Accurate Predictions[13]

The problem: Salesmen want price reduced from 40¢/lb. to 35¢/lb.

How much must be produced to make a profit at the new price?

Present plant capacity: 1,500,000 lb./yr.

Present production rate: 1,000,000 lb./yr. This is all sold.

	Current Operating Level At $0.40/Lb.		Assumed Operating Levels At $0.35/Lb.			
Capacity, lb./yr.	1,500,000		1,500,000		1,500,000	1,500,000
Sales, lb./yr.	1,000,000		1,200,000		1,350,000	1,500,000
Sales for the yr.		$400,000		$420,000	$472,500	$525,000
Less cost of sales						
Factory costs	$230,000		$271,000		$285,000	$300,000
Freight & del.	30,000		36,000		40,000	45,000
Selling expense	20,000		25,000		25,000	25,000
Administration	10,000		10,000		10,000	10,000
Research expense	10,000		10,000		10,000	10,000
		−300,000		−352,000	−370,000	−390,000
Earnings before taxes		$100,000		$68,000	$102,000	$135,000

Earnings before taxes are now $100,000

Producing 1,350,000 lb. brings earnings to only $102,000

CONCLUSION: To justify 35¢/lb. plant must operate at full capacity

ess industries have not borrowed from the cost accounting techniques of long established industries. A number of cost accounting methods and cost control plans for chemical processes were developed from practices in rolling mills, machine shops, and locomotive works. While a "cost center" basis for a milling machine may apply equally well to a kettle operation, such as making alkyd resins, it is hard to adapt this procedure to most chemical processes.

A continuous strip steel mill may resemble a continuous sulfuric acid plant in the need for continuous operation, but the cost factors of materials, labor, power, steam, or maintenance are so different as to make a comparison almost impossible.

Need for Cost Controls

The fire-alarm technique of cost control is familiar to most of us. The company executives find a dwindling cash balance, or sales resistance at a profitable price, or new products stealing a market. Then comes the budget reduction, the economy drive, the conservation program, or more simply, the axe.

Objective usually is to cut out fat, and the hazard is that the flesh is cut too deeply in the process. Worthwhile expenditures, needed for future profits, may be cut along with the luxuries, simply because no one knows for sure which is which. Good cost control can provide the necessary flexibility to meet real emergencies, and at the same time control and reduce costs on a sensible long-term basis. Cost responsibility must be constantly highlighted to be sure proper executive action is taken.

Basically, any business control plan both raises and answers questions on the operation of business. Even the simplest listing of expenditures raises questions on the part of the alert executive. But while a listing may answer the questions of "how much, where, and when," it leaves unanswered "why and who". Operating management should have available from its cost reports not only how much was spent, but how much should have been spent, and how much should be spent in the future operations of the business.

Emphasis Is on Yields

It is still true that the cost factor of most importance in the chemical process industry is normally the value of raw materials.

These may far outbalance all other costs, including wages and plant maintenance items, which are usually carefully scrutinized. The price paid for raw materials may make the difference between profit and loss, and may have many times the effect of a new wage rate.

With the emphasis in the chemical industry on materials, there results an obvious emphasis on yields, or the efficiency of getting most from the materials used.

One dramatic example concerns the drop in bulk cost of penicillin within a few years from five dollars to a few cents a dose—largely the result of improved yields through better technology. The 10 to 15% yields in the early days of penicillin production have been steadily improved, approaching 100% as output went up rapidly, with the same input of raw materials and labor. The companies that improved yields rapidly made good profits. The rest were eventually forced out of the business.

And yet in the face of the importance of yield and raw material costs there are many chemical processing companies which neglect these factors in their "cost control" systems. The foreman may keep a yield record daily in his own notebook, and the chemical engineer may check it sporadically as a matter of interest in process design—but the chemical engineer manager may have trouble getting this information. And, while the yield data may be buried in other cost data, it is certainly not where it will flag his attention. This may not be true in your company, but it does occur.

Another special factor in these industries has been rapid obsolescence of plants and equipment as a result of improved technology. The life of a chemical process, or of a new drug, may be as short as a year or two.

New products or processes may require new costly equipment to make the desired profit. They may require a write-off in the short period before a better process or product is discovered. To keep up with these rapid changes in technology calls for accurate, readily available process cost information, in addition to adequate research and engineering. For proper evaluation, the contribution of technology to profits requires sound financial judgment as well as technical judgment.

What Cost Control Can Do

While cost accounting and competent chemical engineering are the basis for a cost systems plan, there are good reasons for adding the control features.

It is not unusual for production or engineering departments to feel that cost reports are useful only for accounting and financial analysis. They know that the production of goods and services is a basic function, and consider accounting functions as secondary in importance. Cost accountants may differ in viewpoint, feeling that the good financial data they produce is useful for control purposes. The objectives of production, engineering, and accounting departments are the same: to reduce costs and to produce profits. A cost control plan suitable to all points of view is therefore not a necessary evil, but a necessary management tool for engineering, operations and accounting use. This point cannot be stressed too vigorously.

Cost control plans specifically designed for the process industries are required. Such cost control should be flexible, for it must be adaptable to individual processes which differ in their cost factors. To be effective, the weapons for cost control and cost reduction should be rifles rather than shotguns.

Usually a cost system gets its start in life as a tool for sales pricing and profit measurement. This also gives some measure of control as a byproduct. In a highly competitive market most prices are set by competition. So, if costs and profits are in a reasonable proportion to prices, even the manufacturing cost is controlled partly by competition. But when a new product comes on the market, or there is no competition, or where the competitive threat leads to fearful rather than intelligent action, then more specific control is needed by management.

Cost Reduction With Control Systems

Cost reduction is one of the most important functions of a cost control system. While "control" implies holding the line, the same methods also produce improvements in costs. The dynamic goal is to increase profits.

A logical first step in cost reduction is to accurately know sources of cost. The process of setting cost standards (the measurement and determination of what a cost should be) and objectives is in itself educational and leads to study of where reductions can be made. When unbiased and accurate process cost standards are set up to show what should be spent, the difference between standard and actual costs is usually eye-opening. Not only are the potential savings shown, but the path to those savings becomes clear.

A proper cost control system looks in two directions: forward to forecast, and backward to review operations. This is done objectively, with a regular frequency, and progressively to point out the needs for control, improved performance, and future plans. The "control" becomes part of a long-term planning for cost reductions, as well as short-term control of operations.

Accurate Measurement and Control

The concepts of measurement and control of costs follow in almost automatic sequence. Determining what costs should be; the setting of standards and budgets; the comparison of actual costs with standards as a measurement of performance; provide the means of control.

Variances (or variations from standard) and the cost performance index (or percent effectiveness; ratio of actual to standard) constitute the most valuable tools of cost management. These are the reins to guide, or if necessary, the whip to stir the laggard.

Accurate Forecasts and Budgets

Traditionally the most commonly used basis for both forecasting budgets and measuring performance is past history. But in the process industries, cost patterns change so frequently and completely that historical information may serve only to confuse. For this reason there is increasing use and appreciation of engineered estimates and accurate standards of cost performance based on engineering studies.[5]

Cost standards, together with production planning, provide a flexible budget of costs which show the expected variations in cost with changes in level of operations. Such a flexible budget provides accurate financial forecasting at the same time as it gives the operating departments a guide to manpower and purchasing requirements—very useful information.

Product Costing and Pricing

Costing and pricing of sales or products, and the measurement of profit, are still a prime purpose of a cost system. With accurate measurement and control of costs, it is relatively easy to set an accurate cost or price tag on the manufactured product and to determine its profitability.

A standard cost, modified by current or forecast performance, is the most accurate measure known of what it should cost to make a product. The use of engineered standards replaces historical data (which may no longer apply, or which may include so many extraneous costs as to be of doubtful value). Instead it provides an up-to-date measure of known and useful value.

"Process variances (variations from standards) and cost performance indexes (ratio of standard to actual) constitute the most valuable tools of cost management."

Equipment Justification

Rapid replacement of products and processes in the chemical industry requires special consideration for each problem of justification of new equipment, and amortization and absolescence of old equipment.

The standard formulas used in more stable industries do not apply generally to the chemical process industries. A simple example is a special purpose reactor for high pressure, high temperature and corrosive application, good only for the one product for which it is designed, or one very similar. It may be made obsolete by a change either in process or product. In comparison a standard machine tool in another industry may be used for many types of products and as part of many processes.

To determine equipment justification as well as potential earnings a good standard for both variable and fixed costs and the degree of variability is the best and quickest way to arrive at a decision. Such information should be readily available from an effective cost control system, since its basic control would be on the variable portion of costs.

Standards and estimates for these variables may be quickly compared with fixed costs and investment costs for determination of when to buy, build, sell or scrap equipment or plants.

Plant Location, Decentralization

A major problem facing many chemical and processing industry engineering staffs is where to locate a new plant. Comparable and equally complex problems involve the relocation of existing plants, the decentralization of operations to several small plants, or conversely the centralization of scattered operations.

All three of these possibilities may be involved, or only the moving of one or more operations within or between existing plants. For a reasonably quick and reliable basis for executive decision, standards, budgets and estimates which are the basis for a cost control plan are readily usable. Many days of estimating work may be saved if this information is quickly available.

Accounting Analysis and Byproducts

An important byproduct of a cost control system involves the study of actual and potential usefulness of cost accounting to the control of operations.

As engineering and operating departments make more use of cost accounting information, there is a realization of still further possibilities for the use of such methods and data.

In nearly every case the accounting department, in working with the engineering and operating groups, finds more useful ways of presenting information, and improved ways of distributing costs so they are reflected in better operating controls. What started as a simple control system usually expands to provide the basis for complete standard cost systems, supervisory ratings, and possibly incentives.

Some additional accounting work and time may be required to make a cost control system effective. While adequate staff work must be provided to reap the rewards of this plan, such accounting department expenses are more than offset in operating cost savings developed by a cost system.

Also, adapting new controls to an existing accounting system will keep new accounting expenses to a minimum. But almost as important to the accountants as savings in operations is the opportunity to analyze accounting services, to put emphasis where most valuable, and be sure that cost accounting pays its own way.

Important Control Techniques

When some measured standards have become established as good workable controls, differences from budget or standard may be regarded as an additional control. This is usually called "variance," and will apply primarily to costs controllable by the operating departments. Other variances, such as those caused by price or volume changes, can be shown separately in unit cost and dollar amounts as required for top management.

One of the greatest aids to executive control is the principle of control by exception.

This means that the busy executive measures performance on only those items which are exceptionally good or bad, which operating management controls and which measure the largest amounts of money. Thus, the emphasis and control is put on costs which represent significant amounts of potential savings. Minor cost elements, or those where control is negligible at the operating level, may be given secondary consideration after the major variances have been explained and acted on.

These controls will tie in with departmental responsibility, and will show a gain or loss for each supervisor's operations. The greatest advantages of using dollar comparisons are to show the relative importance of each cost variation, and to highlight each supervisor's cost performance. Gain or loss information for a department brings a consciousness of profit responsibility, and therefore, more incentive for cost control.

One large company with chemical, paint, and food processing plants throughout the United States has decentralized its cost control system to the utmost.

Each plant has a monthly profit and loss statement, and each department within each plant has a gain and loss statement. In this way the responsibility is spread to the field, with every foreman responsible for producing a reasonable gain over his standard cost, and each manager responsible for producing a reasonable profit. This provides the maximum indirect incentive for each man to control the costs within his sphere of responsibility.

With a dollar measure of departmental performance, it is easy to take the next step and show percentage performance as a measure of efficiency or effectiveness. With the budget reflecting normal operation, the ratio of standard to actual cost becomes the percent performance.

One hundred percent may be taken either as the ideal theoretical cost or as the "normal" cost, and performance judged accordingly.

Such measurement compares departments on a relative basis. The

manager of a small department may then compete on a percentage basis with one whose operations are many times as big in dollar volume. This makes possible a performance comparison of a large tonnage chemical production unit with a small operation making fine chemicals or pharmaceutical intermediates. For over-all control of the plant or division these monetary and percentage performance factors may be combined to give one a total measure of performance for the various operations.

"When unbiased and accurate process cost standards are set up to show what should be spent, the difference between actual and standard costs is usually eye-opening."

Applying Principle of Exception

Accountants and operating management generally agree on the principle of exception, but agreement on the application is frequently more difficult. At the start, therefore, maximum and minimum limits may be set for use in the budget.

Experience will normally determine the range. Application will depend on the size and technical requirements of individual departments or operations. Limits may apply to unit costs, total costs, performance percentages or budgets. As the budget estimates become more accurate, or for year-to-date or long-term comparisons, closer limits may be made.

Additionally, certain minimum limits may be set to exclude minor cost items from major consideration, so as to concentrate attention on the major items.

For example, it may be desirable to set a monetary or percentage limit on costs which will be budgeted, or standards set, for control purposes. This might exclude all cost items of a total amount under $100 per month (or more in large operations), or those cost items comprising under 1% of the product or department cost, or under 5% of the processing cost.

The smaller amounts can still be shown for control of departmental supervision, but only the more important comparisons would be summarized and pointed out for over-all plant control.

Emphasis also should be on the controlability or reducibility of the cost. One other exception may therefore be needed to prevent dissipation of management time. Certain costs, such as depreciation on buildings, are fixed and subject to very little control by individual operating departments. These items, including staff and service departments, may be shown as total budgets for control by the plant manager. They may be used in the operating department budgets for estimating and information purposes, with action or explanation required only to the extent that responsibility is realistic, but should not require the time or effort for explanation at the lowest operating levels.

The best place to control or reduce costs is as close to the source as possible.

Better cost performance by departmental foremen makes the cost control job easier for the rest of management and provides greater profit. A major purpose of a cost control system is to provide usable controls and cost information for departmental or cost center operation as well as for top management control.

Costing by cost centers or work centers is a means of grouping cost responsibility for a small group of men and equipment. Use of these controls, and the group method by which controls are established, do two things. First, the department heads are better informed on the sources of cost and therefore better able to control and reduce them. Second, each man in the management team increasingly feels his responsibility for his own cost performance and therefore has a greater incentive for improvement.

To provide the operating supervision with usable controls, it is essential to show both sources of cost and the sources of variance, from budgets or standards.

By so doing, those sources for which the operating department is directly responsible are shown and attention is focused on them. Required action can then be taken to reduce costs.

Unless differentiation is made, the various sources of cost may completely hide good or bad performance as changes in the unit cost (per ton, pound or gallon) may reflect changes in operating efficiency, or in raw material prices, or in sales volume—all of which are controlled primarily by different groups of management.

To pinpoint responsibility more accurately, the principle sources of manufacturing cost variation may be separated into these classes:

- Operating—consisting of directly controllable costs, such as the use of labor or supplies.
- Raw material usage — based on comparisons with theoretical or normal yields.
- Material cost price—based on current or contract prices for materials.
- Production volume—using estimated normal production as a budget basis, this provides a basis for comparison with theoretical 100% capacity operation. Percentage of budget and of capacity are additional indications of performance and responsibility.
- Overhead costs and prices—based on the fact that primary control here is in the staff or service department, with the operating department jointly responsible for the use made of the services, but with the total amount "fixed" to the operating departments for the accounting period.

How to Use Control Reports

In the application of basic control principles many cost systems have been devised. These systems differ in detailed application, but the most successful ones have followed similar patterns.

Primarily, the system developed are of two types—"standard cost," and "flexible budget." Many applications are combinations of the two. All are tied in with a good fundamental system of double entry accounting.

Since all accountants do not agree on definitions, the descriptions here will be broad in scope, as will the systems mentioned. They all have the same purpose: to determine what production did cost, should cost, and should have cost, in order that it may cost less in the future.

Using Standard Costs

The term "standard cost" has sometimes roughly described systems in which a rough bogey cost is set by judgment and past history

as some measure of control and performance. And it has been used dogmatically to define systems in which each item of material and operating cost is measured with a standard; the standards used for costing sales and possibly for cost control purposes.

Other systems labeled "standard cost" include engineering or work measurement methods for setting labor standards, or other operating standards for material usage, material prices, or maintenance costs.

All of these are to some extent standard cost systems. Up to the point of a practical maximum, their value increases with accuracy and completeness.

What Flexible Budget Means

A flexible budget recognizes that some costs vary with production and sales volume, and others do not.

Direct labor or direct material may vary approximately as the number of pieces or tons produced. But depreciation charges on buildings do not vary with production volume when straight line depreciation is used.

Between these extremes other sources of cost may be combinations of fixed and variable costs. A realistic budget must recognize these differences in cost variability and use either standards based on ranges of variability (in a standard cost system) or allow for volume changes in budget estimates.

Other flexibility factors may also be built in, including fundamental or large-scale price and wage rate changes. For either budget forecasts or cost control purposes, the flexible budget provides greater accuracy and more current information than the fixed budget method.

Service and Staff Budgets

Although the control emphasis is usually on the operating departments, a large portion of operating costs in a process plant may be under the control of the service departments.

The practice of having specialists in charge of such functions as chemical control and development, maintenance, accounting, or industrial relations, saves costs when effectively carried out. That is, a staff department can be effective in reducing direct operating costs to more than pay its own way.

This has started a trend in industry to increase "overhead" and decrease "direct" costs. For the same or equivalent operation, overhead to direct labor ratio is increased, but total cost is decreased. For this reason some companies, using ratios of overhead to direct costs as controls, have found their systems to be fallacious.

A difficulty in control of overhead or staff costs lies in the lack of measurement of requirements and of effectiveness.

Two types of study are needed to determine this need, and to set budgets. One of these is a study by management of the need for each function as a specialty: the extent to which it contributes to the effectiveness of operations; and the possible combinations of functions to reduce overhead costs.

A second, and more detailed, study may be needed as a supplement, using industrial engineering work sampling techniques, to determine how much time is actually required to carry out the service functions.

The first study would evaluate the need based on management experience, the second would provide the means for closer evaluation of this experience. From such studies budgets for the service departments may be planned, setting amounts of expenditures for general levels of production and plant activities.

One of the important phases of a service department budget is to estimate that portion which is variable, and provide some reasonable measure of variability. Historical data are not usually comparable.

By breaking down the functions to details, and measuring time requirements, a comparison can be made between normal production, maximum production, and zero production. These three points, together with a statistical record of actual results and requirements will enable a curve of variability to be determined, accurate enough for budget control and forecasting.

Basis for Cost Standards May Vary

In producing departments other problems show up.

Single product departments may vary in budget and cost basis from multiple product operation, or from multiple operation departments.

For example, sulfuric acid production is a relatively simple one-product operation. All costs within the operation are applicable to just the one product and its various grades. It can be costed accurately on a standard unit basis (dollar per ton of standard sulfuric acid produced).

A simple chemical reaction, but a more complex product line, is illustrated by the manufacture of alum. It may be sold as liquid alum, or it may be further dried, crushed and ground. The extra operations are additional costs. Therefore, a breakdown of costs by operations is needed for accurate costing of various alums.

More complex is a multiple product operation frequently found in the organic chemical field, where the same equipment can be used in different operations for similar products.

An example is the production of many diverse resins in one set of kettles. Such a combination usually shows unique cost factors and may require standards based on kettle-hours for correct costing.

Similarly, there is the problem of costing an operation in which many products and byproducts are made from a single raw material.[5]

Two examples are typical of many in the chemical processing industries: first the cracking of petroleum crudes to gasoline, fuel oils, lubricating oils, greases, waxes, tars, petrochemicals; and second the processing of soya beans to oils, feeds, lecithin, protein chemicals, steroid chemicals, etc. Here the costing of each operation to the individual final product and byproduct may be somewhat arbitrary. It is possible, however, to control cost according to the cost of unit operations. Usually engineering studies are required as a supplement to accounting proceedures to produce accurate standards.

Types of Standards You Can Use

Even with these variations, it is still possible to define certain types of budgets and standards which can be used in many chemical operations.

One simplification, frequently used to speed up the start of a control plan, is to designate each item of cost as either completely fixed, or completely variable with production. Since almost all elements of cost have some fixed and some variable components, this procedure will create inaccuracies to be corrected later as the budget

basis is refined. The following then, are the general types of standards within these limitations, representing most which normally occur.

- Unit cost—based on a constant usage of material or hours per unit produced, and a constant or standard price.
- Unit usage—based on a constant usage of material or hours per unit produced, and a variable price.
- Unit cost at level—based on the fact that costs go up or down by steps as the level of operation changes, and that unit usage and price is virtually constant within certain ranges.
- Fixed total dollars—based on a fixed amount of charge each month, which does not vary with the level of operations—depreciation charges on equipment or buildings, or a constant usage and price over a period.
- Fixed usage—based on a fixed total usage of a chemical or of labor hours, with a variable price.
- Fixed total dollar amount or a usage that varies in steps as the operation level changes.
- Time cost—based on a cost per hour, or per day, to operate a department or process. In a continuous process this may be cost per hour or month. In a batch process, it may be cost per kettle hour operated.
- Ratios and combinations — based on combinations of sources and types of cost within one element.

Types of Variation of Costs

Infinite are the ways in which costs may vary. Since costs are the result of many factors, their variations are complex.

The types of standards previously discussed are an attempt to freeze the number of kinds of variations to be considered, and thereby simplify cost analysis and control. To help to visualize some, a few simple examples will illustrate basic concepts.

The terms "fixed" and "variable" costs appear in this discussion, and in almost every discussion of costs. Yet frequently there is disagreement as to which is which.

As normally used, the term fixed cost indicates a cost in which total dollar cost remains fixed but cost per unit produced varies inversely with production. One of the best examples is that of depreciation costs of a factory building which may continue at the same rate year after year regardless of the production. If production is doubled the depreciation cost per unit will be cut in half. This is shown graphically in Fig. 1.

The normal definition of a variable cost is that the total dollar amount varies with production (or with sales, or with usage, or with the particular influencing factor).

A primitive example would be that of man, digging a ditch with a shovel, who can dig ten ft. in one hour, twenty ft. in two hours, and so on. Taking just the cost of direct labor, it would cost ten times as much to dig ten ft. of ditch as to dig one. So the cost is variable, even though cost per ft. (unit produced) remains constant.

Another example may be a man who fills steel drums with a liquid chemical. His output does not depend on the number of drums he fills: in one hour he can load 10 drums, in two hours he loads 20 drums, in three hours 30 drums.

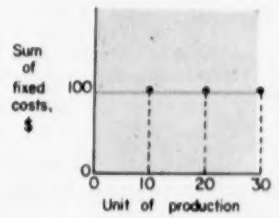
Very few costs are so simple. Usually they are combinations of many factors.

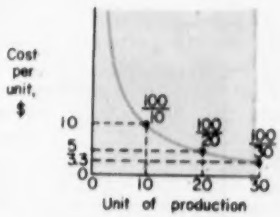
The most frequently encountered combination is a fixed plus variable where part of the cost remains a

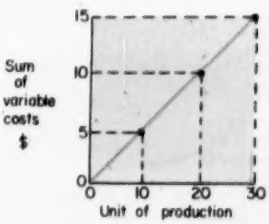
By FIXED COST
Do You Mean FIXED TOTAL COST or FIXED UNIT COST?

Fixed Total Cost
Means
Variable Unit Cost

A typical fixed total cost is depreciation on a building—it does not depend on production volume.







Variable Total Cost
Means
Fixed Unit Cost

Typical variable total cost is operating labor. It varies with production volume.

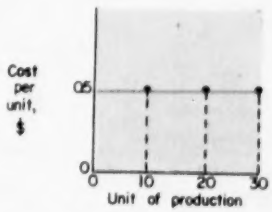
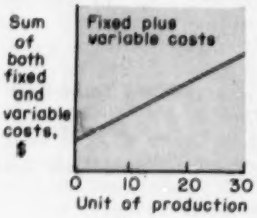


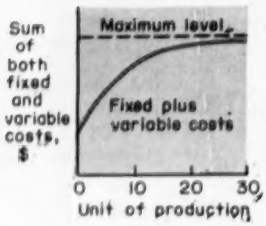
Fig. 1

Actually Processing Costs Are Mixtures—Fixed and Variable

For Example . . .

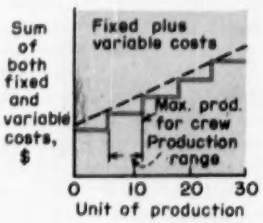
A production crew can operate within a range of production, but beyond that, additional operating people must be brought in to boost production.

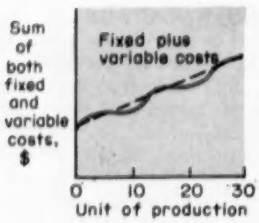




Supervisor represents a fixed total cost. Operating labor is a variable cost. Size of operating crew depends on production volume, but one supervisor can handle crew.

Supervisor is a fixed cost, and the operating crew is a variable cost. However, a maximum point is reached, where production increases without increased costs.





Production crew and equipment (or other variables) can operate over a range. For additional production a number of variables must be added to the process.

Fig. 2

fixed total amount regardless of production, and part varies directly as the units produced.

As a simple example, let us suppose that we now have a whole crew of men available to dig our ditch as required, all at the standard rate of ten ft. per hour, and supervised by one man on a fixed salary who is on hand whether or not ditches are dug. Total daily cost for the ditch will be total daily salary of the supervisor plus daily direct labor cost for the number of feet dug. And the cost per unit will be these dollars divided by the number of feet produced. Graphically, this will be a combination of the two previous sets of curves, and is shown on Fig. 2.

In plant practice there is a frequency noted tendency for costs to remain constant at certain levels of operation, and then to go up or down by steps as production varies. For example, a crew under the pressure of increasing requirements may turn out increasing amounts of work, up to the point where no more overload can be taken and an additional crew is required. Then again this crew may increase productivity up to their maximum, and more people, and labor cost, are required. This is repeated as each crew increases productivity up to their maximum and more people are required for an additional increase in production.

This graphically, is the step pattern. And total cost may vary as straight steps, or as a curve, or level off slowly at a maximum as shown on Fig. 2.

These are but a few of the common examples of how costs may vary. Enough accurate statistics on actual costs will normally form patterns and trends of cost variation. For ease of use, standards are normally set on simple patterns of fixed and variable costs, knowing that these patterns will come close to most situations.

To analyze costs, or to form the basis for more accurate standards, statistical and graphical studies may prove valuable tools for cost management, both for setting standards and forecasting trends.

Practical Value of Cost Standards

A study of cost variation can be a valuable tool for estimating and control. A large food processing company had a triple problem, requiring this type of study, to determine basic operating data. They needed to know:

1. How much certain products, produced in otherwise slack production periods, contributed to profits.
2. To what extent could the operations of several processing plants be combined to reduce overhead costs to a minimum.
3. What information could be developed quickly to provide the starting point for a cost control system.

The solution to these three problems used a graphical analysis of cost variation, supplemented by accounting and industrial engineering studies.

Some of the production cost variation curves demonstrated typical variations which were expected, but also provided numerical data for estimating and budgeting purposes. Some typical curves from this study are shown in Fig. 3.

Contrast Reports Are Valuable

Cost information is most valuable when it receives maximum management use for control purposes.

Cost reports therefore, are best used when they provide control information in simple and easily used form.

Exact form of the report will differ in each company, according to specific requirements. Certain general types of information, however, have been found most useful, and provide a starting point for the design of a reporting system.

Some typical process control charts are shown in Fig. 4.

Usage and Yield Reports

For operating departments a comparison of usages and yields provides a quick and easily available guide to cost control. This is especially valuable in comparison with standards. Reports on usage and yield may be prepared daily (and weekly and monthly) from production data, without taking the time for costing. This gives prompt information and the chance to correct difficulties as they occur.

Normally such a usage report would compare labor hours to standard hours, or earned hours, and show performance percentage and variance. Also, raw materials, supplies, and utilities may be included as a comparison with a standard.

A useful basis for comparison is frequently equivalent number of men on the payroll. It is easier to visualize ten men too many than 400 man-hours of variance for the week.

Labor standards, and even material usage costs, may easily be converted to equivalent men to accent the degree of control.

Prime requisites of such a report are promptness, simplicity, ease of use, and a degree of accuracy which is consistent with these other requirements. Such usage data subsequently becomes the basis for the operating cost reports with the addition of dollar values.

Operating Cost Reports

With a daily usage report as the primary operating control the operating cost reports may be issued weekly or monthly to emphasize the dollar value of control.

Even to an experienced foreman or manager the figure $2,000 may have a clearer and more easily visualized meaning than 1,000 man-hours or 10,000 lb.

Also, here it is again important to emphasize the standard or budget to show what should have been spent. Cost factors normally included as operation costs are:

- Labor—wages and salaries.
- Materials—yield and loss factors.
- Supplies.
- Utilities (steam, water, power, fuel).
- Maintenance labor and materials.

Other Useful Cost Control Reports

Overhead or burden costs are normally controlled by top management. And reports on such costs should be designed for top management use.

All levels of management and engineering however, should be instructed in overhead costs and how they grow, and should be informed of their own portion of this responsibility.

A chemical engineer's recommendation for new equipment, for example, should indicate the effect of the addition on overhead. While new equipment may reduce direct operating costs, it will probably increase depreciation, taxes, and other investment costs which are part of management consideration.

Product costs are of primary interest to top management and sales management, even though controlled partly in operations. A well designed reporting system should perform the functions of providing sales pricing and profit information and pointing out cost responsibility. The use of standard costs for pricing and profit estimating, and performance and variance data for actual cost and profit performance is one excellent means of doing this.

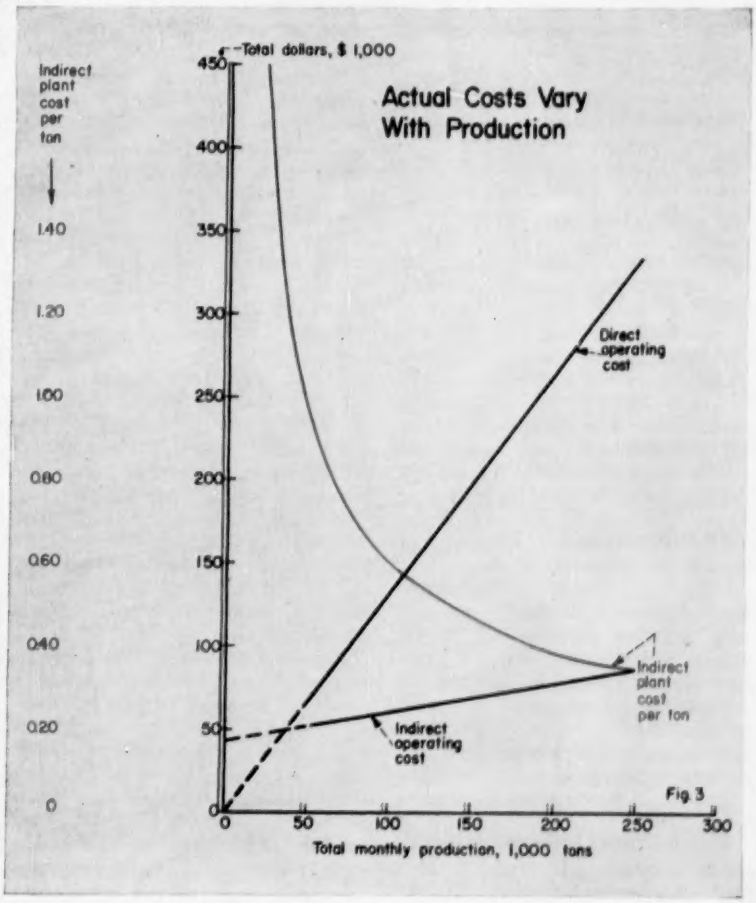
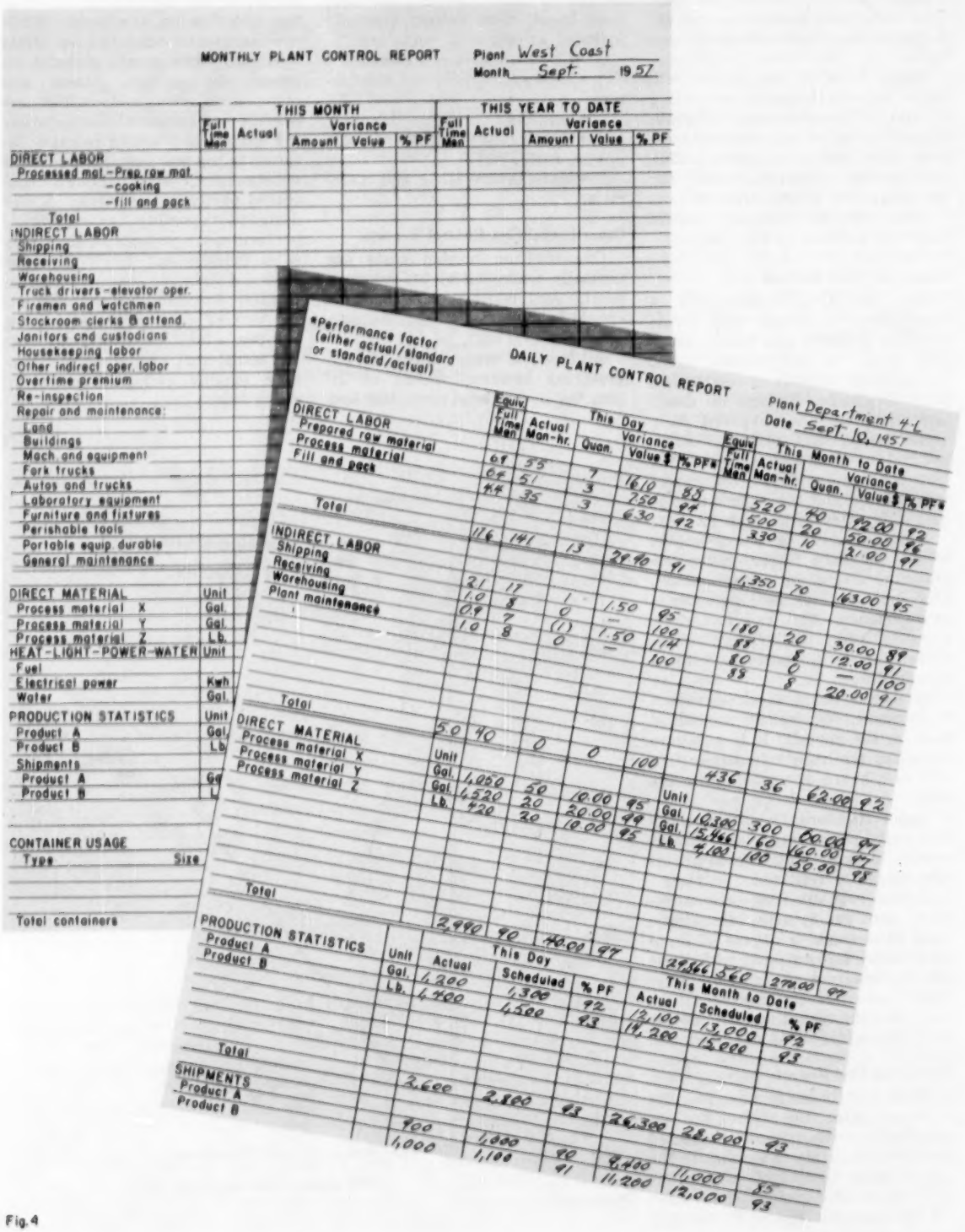


Fig. 3

Cost Control Charts for the Process Industries



MONTHLY PLANT CONTROL REPORT

Plant West Coast
Month Sept. 1957

	THIS MONTH					THIS YEAR TO DATE				
	Full Time Men	Actual	Variance Amount	Variance Value	Variance % PF	Full Time Men	Actual	Variance Amount	Variance Value	Variance % PF
DIRECT LABOR										
Processed mat.-Prep. raw mat.										
-cooking										
-fill and pack										
Total										
INDIRECT LABOR										
Shipping										
Receiving										
Warehousing										
Truck drivers-elevator oper.										
Firemen and watchmen										
Stockroom clerks & attend.										
Janitors and custodians										
Housekeeping labor										
Other indirect oper. labor										
Overtime premium										
Re-inspection										
Repair and maintenance:										
Land										
Buildings										
Mach. and equipment										
Fork trucks										
Autos and trucks										
Laboratory equipment										
Furniture and fixtures										
Perishable tools										
Portable equip. durable										
General maintenance										

DIRECT MATERIAL	Unit									
Process material X	Gal.									
Process material Y	Gal.									
Process material Z	Lb.									
HEAT-LIGHT-POWER-WATER	Unit									
Fuel										
Electrical power	Kwh									
Water	Gal.									
PRODUCTION STATISTICS	Unit									
Product A	Gal.									
Product B	Lb.									
Shipments										
Product A	Ga									
Product B	L									

CONTAINER USAGE										
Type	Size									
Total containers										

*Performance factor (either actual/standard or standard/actual)

DAILY PLANT CONTROL REPORT

Plant Department 4-L
Date Sept. 10, 1957

	Equiv. Full Time Men	This Day Actual Man-hr.	This Day Variance Quan.	This Day Variance Value $	This Day Variance % PF*	Equiv. Full Time Men	This Month to Date Actual Man-hr.	This Month to Date Variance Quan.	This Month to Date Variance Value $	This Month to Date Variance % PF*
DIRECT LABOR										
Prepared raw material	6.1	55	7	16.10	88		520	40	92.00	92
Process material	6.4	51	3	2.50	92		500	20	50.00	96
Fill and pack	4.4	35	3	6.30	92		330	10	21.00	97
Total	17.6	141	13	24.90	91		1,350	70	163.00	95
INDIRECT LABOR										
Shipping	2.1	17	1	1.50	95		180	20	30.00	89
Receiving	1.0	8	0	—			88	8	12.00	91
Warehousing	0.9	7	(1)	1.50	100		80	0	—	100
Plant maintenance	1.0	8	0	—	114		93	8	20.00	91
					100					
Total	5.0	40	0	0	100		436	36	62.00	92
DIRECT MATERIAL										
Process material X	Unit					Unit				
Process material Y	Gal.	1,050	50	10.00	95	Gal.	10,300	300	60.00	97
Process material Z	Gal.	4,520	20	20.00	99	Gal.	15,466	160	160.00	97
	Lb.	420	20	10.00	95	Lb.	4,100	100	50.00	97
Total		2,990	90	40.00	97		29,866	560	270.00	97

PRODUCTION STATISTICS	Unit	This Day Actual	This Day Scheduled	This Day % PF	This Month to Date Actual	This Month to Date Scheduled	This Month to Date % PF
Product A	Gal.	4,200	4,300	92	12,100	13,000	93
Product B	Lb.	4,400	4,500	93	14,200	15,000	93
Total							
SHIPMENTS							
Product A		2,600	2,800	93	26,300	28,000	93
Product B		900	1,000	90	9,400	11,000	85
		1,000	1,100	91	11,200	12,000	93

Fig. 4

Fair Reporting of Performance

One of the best incentives to improved cost performance is accurate and fair reporting on that performance. Any worthwhile manager will work harder when he has the chance to know and evaluate what he is doing, and also knows that others are watching his performance.

Performance can best be measured in operating departments by comparisons of actual to standard costs. From these are obtained a percent effectiveness which is the standard divided by the actual cost, providing a good performance rating.

Variance provides a measure of the size and value of the control.

The next step in analyzing cost performance is to come as close as possible to a profit statement in each unit or segment of the business.

In accord with the principle of control by responsibility, only certain portions of cost may be controlled by one individual. For example, an operating department cost may vary according to the volume of production or the cost of raw materials, as well as the departmental effectiveness. And the department head is usually too remote from the control of sales volume or raw material purchasing to exercise any control of these costs.

To provide a fair comparison of departmental profit a surplus and deficit statement may be used, which is broken down into operating surplus, volume variance, and price variance. Other variances (such as overhead) can be split out if required or justified.

All of these add up to profit and loss statements showing the contributions of all phases of management. And from these should come greater management contributions to profitability.

Cost Reduction with Control

The process of setting up cost control budgets leads easily and naturally to cost reduction. Studies of the sources and control of costs provides the basis for the next step, which is to cut costs and thereby increase profits.

Since competition sets the prices for most products, profit margins must depend greatly on competitive costs, and constant improvements in cost performance. While we cannot present here all the possibilities for costs reduction, there are several lines of study indicated for intensive work in process industries.

Both chemical engineering and industrial engineering techniques normally are used in process control where these functions are available. These engineering techniques can contribute both to a greater accuracy of measurements and to the studies required to point the way to lower costs.

In companies where full-time engineering departments are not available, or where the start of such a program requires extra help, the services of consulting engineering firms may greatly speed up the program.

Reducing Material Costs

In the chemical industry, cost of materials is normally a large part of the cost of the product.

At one typical process plant recently studied the raw material and chemical cost for a year was about 63% of the total production cost, with wages and salaries at 18%, and all other costs making up 19%. The need for emphasis on materials costs is obvious. The two main phases of this study, by chemical engineering techniques should be:

- Improvement of yields and quality of product.
- Substitution of less expensive materials.

This may be obvious to the chemical engineer, but needs constant emphasis in all phases of process management.

Manning Studies to Reduce Costs

Even in the most modern, automatically controlled process operation, manpower and its costs are important. The study of manpower requirements in the operating departments is usually a continuous process since this cost is theoretically the most controllable of costs.

Operating labor cost varies somewhat with production rates, usually in steps, but with a certain amount of it fixed right down to zero production.

Supervision is more fixed for a range of operations, but still somewhat variable and subject to control.

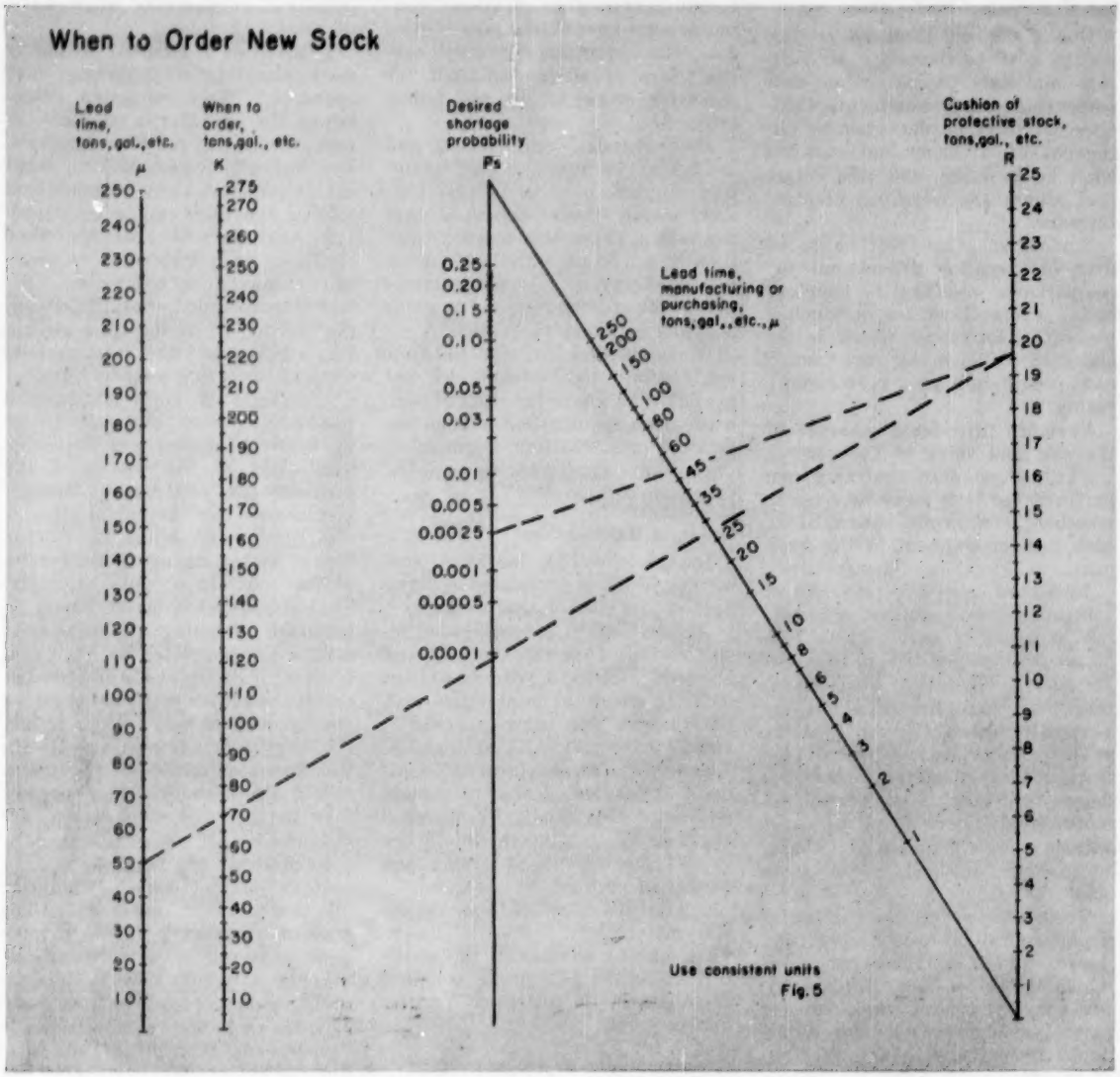
Needed to supplement proper employee selection and supervisory control are five types of study by industrial engineering work measurement techniques:

1. Analysis of time utilization by work sampling methods for each operation. Work sampling determines the actual use of time by spot checks at random intervals, and indicates where and to what extent reductions can be made and jobs or functions can be combined.
2. Analysis of jobs by time study, using a stopwatch or other work-measurement techniques. This is a more detailed study, following the indications of the time utilization studies, and the recommendations of operating suppervisors.
3. Studies of job methods, and combination or elimination of work. Such studies are a specific application of the results of the previous two analyzes of departmental time and individual jobs.
4. Studies of plant layout for flow of materials, using the results of the first three types of study. This applies work-measurement to materials handling problems. As results are completed by an industrial engineering study it then becomes the function of the operating management to take action. Industrial engineering methods are in this way a valuable tool for use in operations, although they do not take the place of management decisions.
5. Studies of paperwork procedures and methods to eliminate all that is not necessary. The amount of paper required to produce a pound of some chemicals may be astounding when investigated. And paperwork, forms and reports, consume valuable time in preparation, transmittal and use. Some is necessary and valuable, but the techniques of the industrial engineer can be used to great advantage to weed out the useless clerical work that grows over the years, and to show the value of mechanization and automation of clerical work.

A second benefit from such manpower cost studies will be more accurate and detailed information for budget use. As ways are found to reduce costs, the budget will reflect improvement. Knowledge of cost sources and variations should provide closer budgeting control and again lower costs.

Operating Rates and Time Cycles

Here again the chemical engineering and production functions



can combine to reduce costs. Improved cycle time for operations may mean more production capacity with the same labor and overhead costs, or fewer men to do the same job, or a great increase in capacity with just a few additional men.

In a continuous process the same effect is achieved by increasing rates of flow or operation. An increase in production rates will lower unit costs, and will need to be balanced with changes in yield or quality. Industrial engineering studies may help here to point the way to potential savings, supplementing chemical engineering studies of the process. Increased flow must be weighed against lower quality or lower yields to show any real savings or lowering of costs.

Quality Control Techniques

While competitive chemical quality standards are an unquestioned necessity to keep a market, some realistic liberalization of standards may show substantial cost savings. A good example of this is the elimination of grinding of a granular or crystalline product, which can be just as well used by the consumer without being reduced to a fine powder.

Such cost reductions may appear obvious to the chemical engineer manager, but a salesman may frequently request too rigid specifications just to be able to claim "Ours is the best because . . ."

Every effort should be made to make sure specifications are reasonable from a process cost standpoint.

Another worthwhile study is that of savings in plant operating costs by improved laboratory control. Faster methods of analysis reduce the process time in the plant by cutting the time of waiting for laboratory results. Also, more accurate laboratory results reduce the

lost time for reprocessing or resampling.

Utilities Can Be Large Factor

A study of utilities costs in process plants (steam, water, electricity, refrigeration, fuel, gas) can best be done from three functional approaches.

The chemical engineering function studies process requirements, searching for those changes in process which may reduce usages. The production function studies the cost and potential savings relationship between utilities and other costs, for the optimum total costs. The mechanical engineering function studies ways and means of producing and distributing the utilities at lower cost. In companies where these functions are combined, the problem should be studied by one person from three different points of view.

Planning and Inventory Control

A production control, or scheduling department frequently finds itself in the uncomfortable position of being unable to completely satisfy its conflicting responsibilities to three important functions: sales, production, and finance.

Sales requirements are usually set to hold or expand a market. In such lines as food, or agricultural chemicals, the seasonal fluctuations of demand can greatly complicate this problem. In meeting sales demands, both practical production problems and cost functions are also important. Unreasonable sales or inventory demands may result in such high costs that the market is lost in the effort to capture it.

In this control function a scheduling department can perform a valuable service to production costs by a careful study of these cost factors:

- Optimum and steady use of manpower.
- Elimination of frequent and costly change-overs between products made in the same equipment.
- Balancing the cost of intermittent operation at a high rate against steady operation at a low rate.
- Balancing the best operating rates with the cost of maintaining an inventory build-up which may be required to obtain it.

Balancing of inventory with costs is a perpetual problem, for which there are, fortunately, some good techniques to provide quick and sound answers. These methods range from simple rules-of-thumb to complex mathematical formulas requiring electronic computers to apply. Basically, the questions are "when to order?" and "how much to order?"

The order point method is a simple determination of when to order. This is the point to place a new manufacturing order, or to start a new material through a process.

Order point is determined by adding manufacturing lead time to the cushion or minimum stock. Reordering at this point should assure an adequate quantity produced before the supply on hand is exhausted. The same method may be used for purchased materials by substituting purchasing lead time for manufacturing lead time.

A nomograph for calculating this information quickly and easily is shown on Fig. 5. In using the nomograph: draw a straight line from a given point on scale P, through a given point on slanted scale μ. Extend this line to intersect scale R. From this point draw a straight line to a given point on vertical scale μ. Read order point (in tons, lb., gal., etc.) at intersection on vertical scale K.

"How much to order" can be determined by the application of economic lot size formulas. Economic lot size, or optimum production run, of an item is the quantity that should be ordered at one time to result in a minimum unit cost. This is a compromise between two opposing economic factors:

1. Costs which increase or multiply as the lot size or length of run decreases (set-up, change-over, paper work and control costs are in this category).

2. Costs which increase as the lot size or production run increases (inventory carrying charges such as earnings on investment, obsolescence, storage costs and spoilage are in this group.

A given annual usage may be provided by making one lot or several smaller lots to provide the same total. For any given usage and cost factors there is a lot size that minimizes cost.

This relationship may be expressed by the simple mathematical formula:

$$Q = \left(\frac{2\,Y\,S}{I\,C}\right)^{1/2}$$

Where Q = Economic lot size quantity
Y = Requirements (annual)
S = Set-up, changeover, or procurement cost
C = Unit cost
I = Inventory carrying charge factor

This factor I in the equation frequently surprises cost analysts who compute carrying cost of inventory for the first time. Enough study has been made of this, however, to indicate that the following factors may be a normal range for most industries:

	Normal range	Maximum
Obsolescence of product	5–10%	50%
Interest on investment in inventory	6–10%	15%
Spoil in storage	2– 5%	10%
Storage (including handling, taxes, insurance, warehousing, etc.)	2– 4%	10%
Total	15–29%	

Nomographs, such as shown on Fig. 6, have been designed to simplify and speed up the calculations in this formula. These may be used either for manufacturing or procurement quantities by substituting the proper data for quick and easy solutions to this problem. To use the nomograph: Connect a given point on line Y and line S with a straight line. Then join the point of intersection on reference line a to a given value on line I. Connect the intersection of this line and reference line b to a given value on line C. Read economic production or ordering quantity at the intersection of this line on line Q.

Determining Production Volume

Overhead costs to maintain a partly idle plant may determine the profitability of an operation. Fixed and semi-fixed costs continue, and must be absorbed by the products which are made, even though the amount of production may not justify the size of the plant. Additional products, or greater volume of present products, to absorb the overhead and reduce the cost per unit manufactured, may be the real answer to a plant's profitability.

This basic cost philosophy frequently is not applied because the total effect of a partly idle plant is difficult to measure.

With the flexible budget or standard cost plan means are available to measure the effect of production and sales volume on operating costs. You can determine ac-

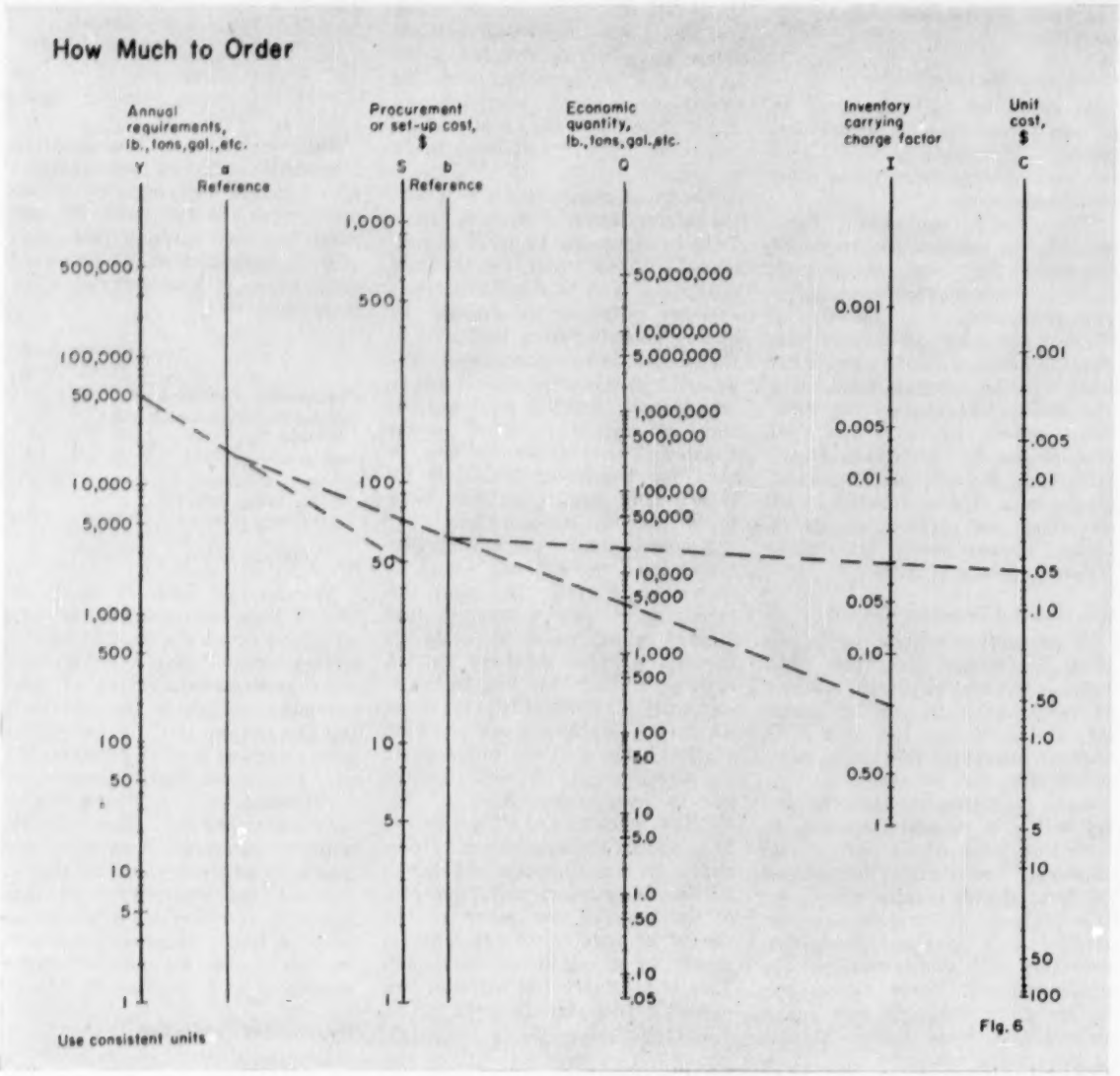


Fig. 6

curately and quickly the break-even and optimum points on the curves.

This measurement, in turn, provides the means for evaluating benefits of increased sales in the increase of profits. New products added to plant operations may be more accurately appraised and priced, their contribution to profit measured. All these factors of cost analysis contribute to a more profitable business.

Operations Research Is Valuable

This comparatively new branch of management science consists of the application of mathematics and the scientific method to the solution of management problems. Its purpose it to provide management with precise, quantitative information to use as a basis for making sound decisions. As such, operations research has been applied to a wide variety of management problems. In addition to mathematical techniques, it makes use of the methods and techniques of cost accounting, finance, and engineering.

Cost Accounting Byproducts

The cost accounting system so far described has many evident advantages for its primary purpose: the control and reduction of costs. But the same tools which provide good cost control may produce many byproducts of almost equal value.

To a large extent the standards set for cost control will supplement cost accounting information, and make possible easier cost analysis. Frequently a special analysis of a cost problem, which would otherwise take days to work out from original data, can be made in a few minutes by using cost standards.

When evaluating a new chemical

process or a new plant, this time factor can be even more important than the saving of work. I have seen a group of chemical engineers work for weeks to determine the economics of a new plant location. An adequate cost system should have provided the information for a preliminary determination in a day or less.

Cost control, cost analysis and cost estimating can be readily combined in a well designed plan.

Simplification of Work

The details of cost control sound complex. Working with new budget plans however often shows how to simplify cost systems. To simplify the system involves both reducing the work required to make it effective; and making it more effective by producing an easy-to-use system.

In one recent control study for a large chemical processing plant, the following simplifications were recommended by accounting, engineering and operating departments.

- Use of fewer decimal places, or rounded figures, in proportion to the accuracy possible or needed. This makes data more usable, easier to prepare, and more realistic. Too many figures are confusing to most users of cost systems. Why work out a cost figure of $1.1346/lb. and then use it as $1.13 in practice? Significant figures can represent accuracy which is both obtainable and required, and will be easier to use.
- Elimination of unnecessary distributions by charging service and staff costs directly to product costs when possible. Charging the cost of a service operation to another service operation is expensive clerical work and of little value.
- Review of distribution of service department expense. This study includes a realistic basis for distribution and the grouping of service department cost by responsibility.
- Combination of processing and packing costs where there is a fixed sequence of operations, or where packing is done directly from process.
- Elimination of budgets or standards which are not realistic or do not represent real control, to concentrate on those which are most needed for control.
- Budgets by major steps or levels of production, rather than by small increments.
- Use of summary presentations of cost and budget comparisons for management control, and the use of management by exception principles to reduce executive control time.
- Combinations of budget controls with other reports.

Mechanization or Automation

The long evolution of mechanization of industry has greatly decreased physical work, making machines more productive than men, raising skills to control machines or processes, and providing an increasingly higher standard of material living. This mechanization came more slowly to the office, even though with the decrease in labor and increase in the complexity of industry, office functions for control of operations proportionately become far greater.

Now, in the last few years, the office is discovering machines. And new machines, high speed electronic computers, as well as improvements in the older electro-mechanical equipment from adding machines to punch card computers, are making office work easier and quicker. The newer machines have added features of control of their own operations. These control features, added to the mechanization of clerical work, gives us "automation" in the office.

New procedures are needed for automation. New simplifications are required to adapt accounting methods to quick and accurate machine processing. A system of cost accounting and control should be built to fit into the degree of mechanization available or required. Also, these same cost methods help to evaluate the need for mechanization.

Pricing Through Cost Systems

Since the original purpose of most cost systems is for product costing and pricing, the improved standard cost system is a greatly more valuable method than previous price bases.

The standard basis, quick availability of information, and the relative accuracy of standard costs, are tremendous aids to sales and profit minded executives.

Profit Planning and Budgeting

A financial budget is the profit plan necessary for long-term successful business. With the flexible cost control budget as a basis, such planning can be more accurate and more realistic.

The flexible basis provides adaptability to changing conditions and new forecasts. It also allows analysis of costs and profits under a variety of possible or probable conditions. In this way executive planning may be done with the most realistic possible view of the future, and therefore the most chance of success.

Cost Control Programs

Cost control does not just happen, nor can it be done entirely by executive decree. Both wishful thinking and desk pounding have been tried and found wanting. A program for action must be formulated, with executive follow-up to see that it is carried through.

Conferences Are Helpful

Conferences are the quickest method for assembling information and ideas. The hazards of substituting talk for action are notorious. Therefore individual decision and action must follow the group approach to make it effective.

A group meeting, with engineering, accounting, operating, and other staff, will develop this study from all points of view and with all available sources of information.

In setting cost budgets or standards, it's essential that the operating department participate. Any standard set without this participation will be viewed by operating men with skepticism or possibly even hostility.

A joint venture by the accounting, engineering, and operating departments makes the responsibility for cost control on the part of the operating department both acceptable and accepted. And jointly these departments may well work out the basis for lower costs and higher profits.

At the start, conferences can be used to work out preliminary cost control budgets or operating standards. Accounting, engineering, operating, and other departments may be included as required. Here are reconciled and combined the points of view of the production supervisors, the chemical engineers, the chemists, the industrial engineers, the mechanical engineers, the accountants, the cost experts in all fields. Theoretical chemistry and

practical experience are thus included in a framework of accounting.

From such conferences, good preliminary cost estimates can be made, and the need for further detailed study indicated.

Conferences also serve to establish responsibility for the control of costs and to indicate cost reduction possibilities.

All concerned are provided with a thorough review of cost accounting, control methods, and problems to be solved. It should be clear that the cost control budget requires the teamwork of several departments and functions.

More Study Required?

Some conferences may lead immediately to control budgets or cost standards. In other cases more study by individuals or departments will be needed. Usually departmental or engineering studies will be needed to supplement the original conference information to obtain more accurate control standards. General types of studies expected are:

- Chemical engineering — for yields, process times, operating and utilities requirements, on material and product specifications.
- Accounting — for historical data, and average usages and costs.
- Operating — for all directly controllable functions and costs.
- Statistical—for data on cost variability with operating volumes, and differentiation between fixed and variable elements of cost.
- Industrial engineering — for manning requirements, labor costs, and materials handling costs.
- Mechanical engineering—for utilities cost, and equipment requirements.

Presentation of Data

Normaily an existing set of cost accounting forms can be augmented or modified to add control data. Standards, budgets, variances, and even comments may be added.

This process of modification is especially valuable at the start of a new system, to speed up use of the information as fast as it becomes available. Experience will indicate when new forms are needed, either simplified or more complete.

Backing up these standards and variances, a set of operating budgets in summary form, and in detail if needed, provides a valuable reference and guide. This presents the control basis for each item of cost, showing standard usages of chemicals, hours, dollars, unit costs, prices, or other budget limits, and compare actual to standard costs.

Such budgets or standards can be the basis for more than the monthly control, since they will be usable for cost analysis and estimating, plant comparison, and both financial and operating forecasting.

In addition, a summary report showing cost variations from the budget usually proves valuable. It can point out those items where good progress has been made, as well as indicating those which need attention. Such use of the principles of control by exception will simplify operating control and make it more effective.

Review and Revision

A good general policy is to start the use of new budgets or standards as fast as possible by applying them to existing reports. Some of the short-cuts and estimates can be put to use quickly, knowing that later revisions may be necessary.

Actual experience in applying the budgets to monthly costs gives an indication of their accuracy and usability. Some adjustments may be found necessary immediately. Others will be made as more accurate cost and engineering studies become available. As major changes are made in operating conditions or in accounting, budget revisions will be needed. In this way, the most usable controls will be available as fast as feasible.

Summary of Expected Results

Principles of flexible budgeting and standard costs will produce a good and workable plan for operating cost control for all chemical process industries. Modern techniques of both engineering and accounting fields are (or should be) included.

Such a plan can be simple enough for a small company or plant, complete enough for control of large operations," and adaptable to process industries of all types.

The application of these sound principles in a well devised system has the potential for large savings in reduced and controlled operating costs. Byproducts of such a system may be greater accuracy of pricing, profit forecasting, analysis and planning. Net result of a good control system will be greater profits to build for the future.

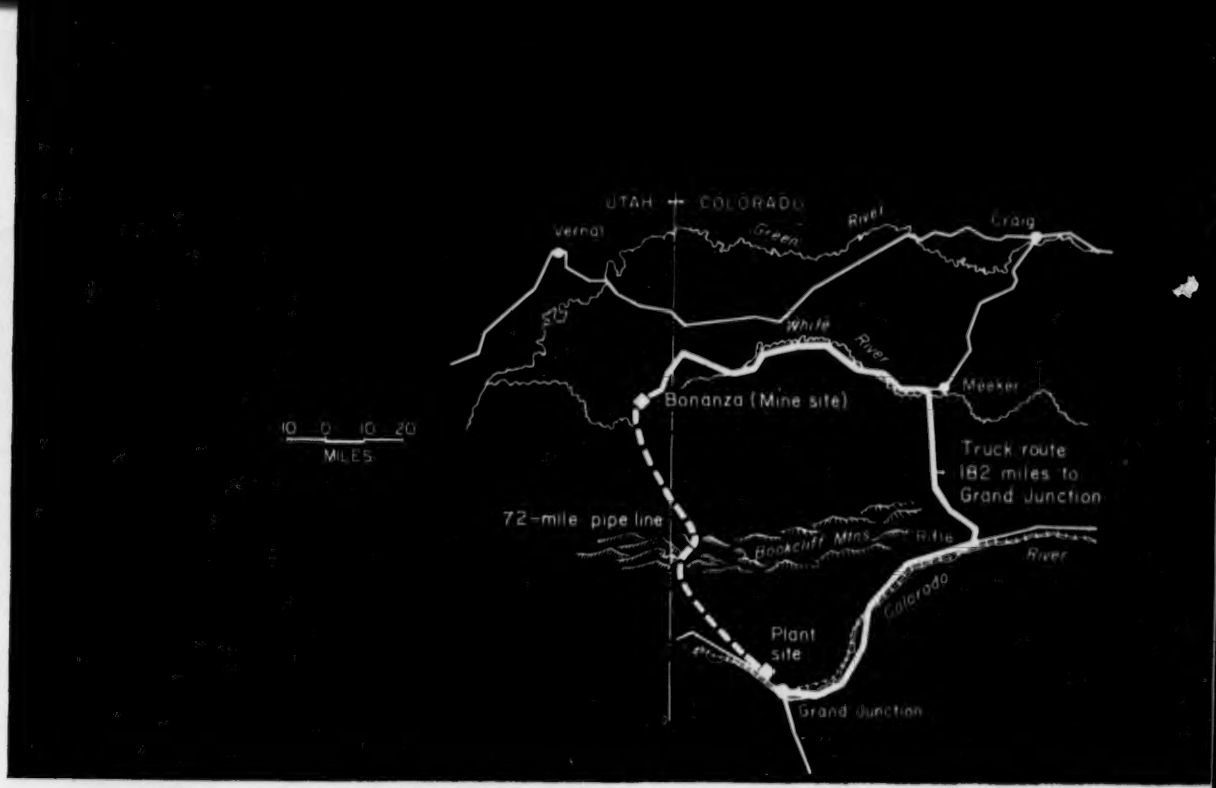
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Designing the Gilsonite Pipeline

A fairly conventional Colorado petroleum refinery is operating on a highly unconventional raw material, the Utah mineral hydrocarbon, gilsonite, brought in as a water slurry via a 72-mile pipeline.

ROBERT K. BOND, Standard Oil Co. of California, San Francisco, Calif.*

Culminating a most vital phase in the engineering development of a refinery project involving more than $15 million investment, one of the world's first cross-country solids-carrying pipelines went into operation on Apr. 15, 1957. This 6-in. line, traversing 72 miles and an 8,500-ft. mountain pass between American Gilsonite Co.'s mine at Bonanza, Utah, and its petroleum refinery near Grand Junction, Colo., now transports 700 tons per day of minus 8-mesh gilsonite as a water slurry. The refinery dewaters the slurry and processes the mineral hydrocarbon by conventional methods to yield 1,300 bpd. of gasoline, plus coke and fuel oil.

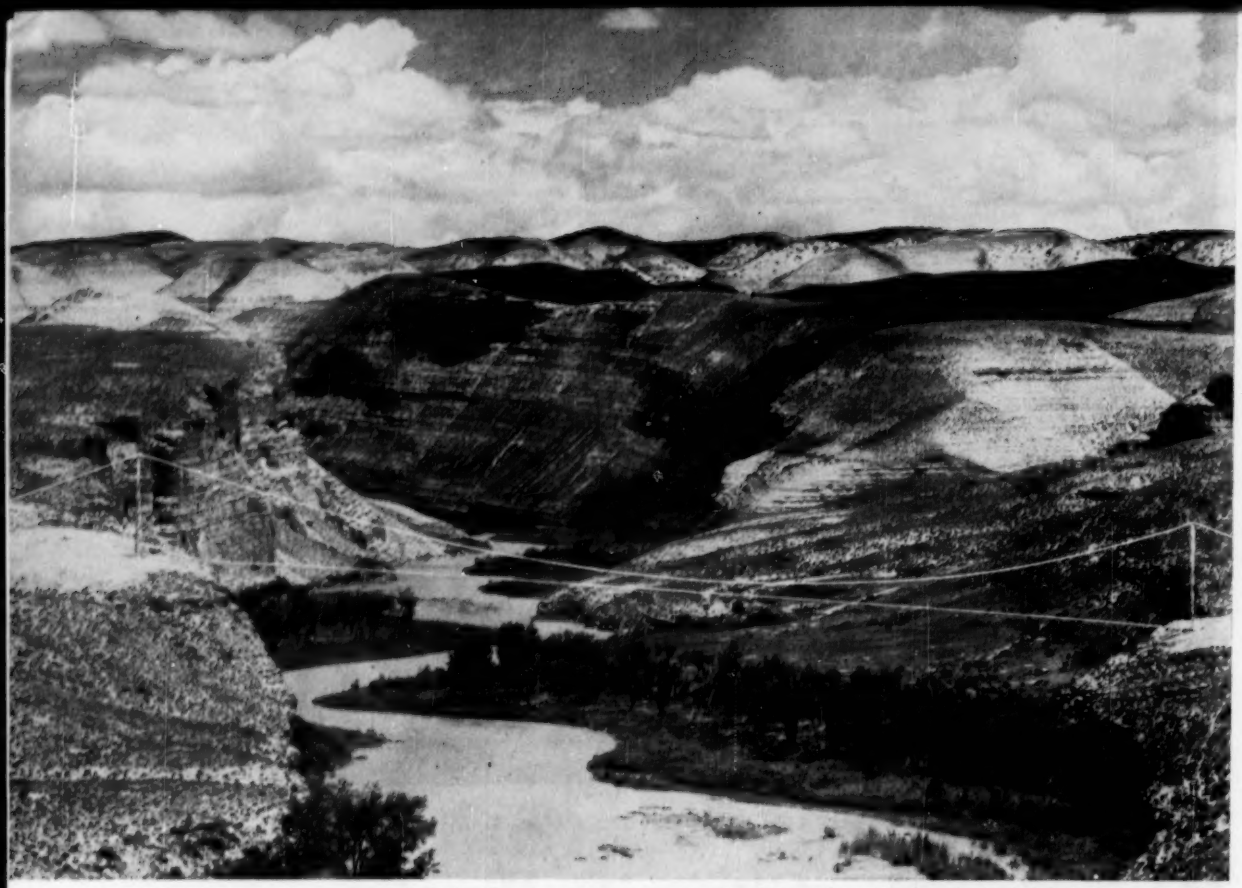
Gilsonite is a unique hydrocarbon mineral found only in the Uintah Basin of eastern Utah. Resembling a hard black asphalt, it is technically an asphaltite. It has been exploited for a variety of uses since the '80's but this has been difficult in the past owing to the remote location of the mines and the extremely rugged and sparsely settled character of the surrounding region.

When American Gilsonite Co., jointly owned by Barber Oil Co. and Standard Oil Co. of California, decided to convert the material to petroleum products, it was logical to locate the refinery where the products could be transported by rail to a nearby marketing area. After considering the various alternatives for transporting gilsonite to the refinery, it was clear that pumping a water slurry by pipeline would be most economical. Rehabilitation of the abandoned Uintah R.R., built at the turn of the century, was out of the question. Trucking would involve a road haul of 182 miles. By building the pipeline along the right of way of the old railroad the distance could be cut to 72 miles and the terrain would be no more difficult than had already been traversed by oil pipelines.

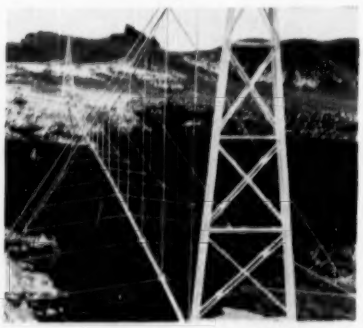
Fig. 1 shows the profile and hydraulic gradient of the pipeline. American Gilsonite Co. requested Standard Oil Co. of California's engineering department first to investigate the alternatives, then to develop and build this unusual transportation system.

Our preliminary studies indicated that gilsonite would be an

* Meet your author on page 348. A similar paper was presented by Mr. Bond before the Petroleum Mechanical Engineering Conference of ASME at Tulsa, Okla., on Sept. 25, 1957.



SUSPENSION bridges carry the pipeline over two canyons; at other points the line is buried below the frostline.



SWAY BRACING is an important feature of the suspension bridge.



PIPE LOOPS handle expansion at either end of the suspension bridge.

ideal material to carry in water and pump in the form of a slurry. Its specific gravity is only 5% greater than water and it is relatively nonabrasive. Also, adequate water was available for the pipeline near Bonanza, Utah, where the company's mining properties are located. Since no industrial cross-country pipeline transporting solid material as a water slurry then existed, there was no background experience to use as a guide. It was necessary to develop the design criteria from pilot model tests.

Tests were subsequently conducted on 500-ft. loops of 4- and 6-in. pipe through which slurry was continuously circulated to determine such factors as flow characteristics of the suspended solids, pipeline corrosion, and reduction in particle size by degradation during hydraulic transport. These tests were designed for the specific problem, rather than slurry pumping in general. They were conducted at the Colorado School of Mines Research Foundation in Golden, Colo. Additional testing was required to develop pumping equipment that would be capable of forcing slurry into the line at pressures over 2,000 psi. Finally, we sent samples of pipeline effluent from the pilot pipeline tests to equipment manufacturers throughout the United States, and to Germany, for testing various methods of dewatering and reclaiming the solids at the pipeline terminal.

The difference in scale between the length of the test setup and the commercial installation was unavoidably great. The pipeline is 750 times as long as the loop used in the pilot model, but the pipe of the test loop was of the same diameter as that in the commercial line. We considered a longer test loop, but results from even a mile-long section would still require considerable extrapolation. It was decided that the expense and time required to conduct the tests on any larger scale could better be spent on the pipeline itself—for added safety factor, if necessary.

Our tests for developing the main-line pumps were run using equipment almost full sized. Two carloads of material were used in the pump tests, but the longest test run was only 15 min. Operating at pump discharge pressures

as high as 2,000-2,500 psi. required a small-diameter pressure breakdown pipe which rapidly degraded the gilsonite particles to very fine sizes. Once degraded, the test batch had to be discarded since the slurry was no longer representative of the material to be pumped.

The commercial pipeline was designed by careful analysis and extrapolation of the pilot test results. Because of test limitations, the design safety factors had to be carefully scrutinized and it was felt prudent to include a reasonable allowance for variables that could not be fully explored in the pilot tests. An allowance of 25% was therefore added to the pressure gradients observed at Golden to cover the factors listed below:

1. Additional pipe internal roughness over test conditions, i.e., roughness that might be present initially or develop after extended use.

2. Effect of low temperature on slurry flow resistance in excess of that accounted for by water viscosity change alone.

3. Effect of swales or changes in elevation of the pipeline.

4. Effect of the chemical dispersing agent used in the pilot tests, but not necessary in the commercial pipeline.

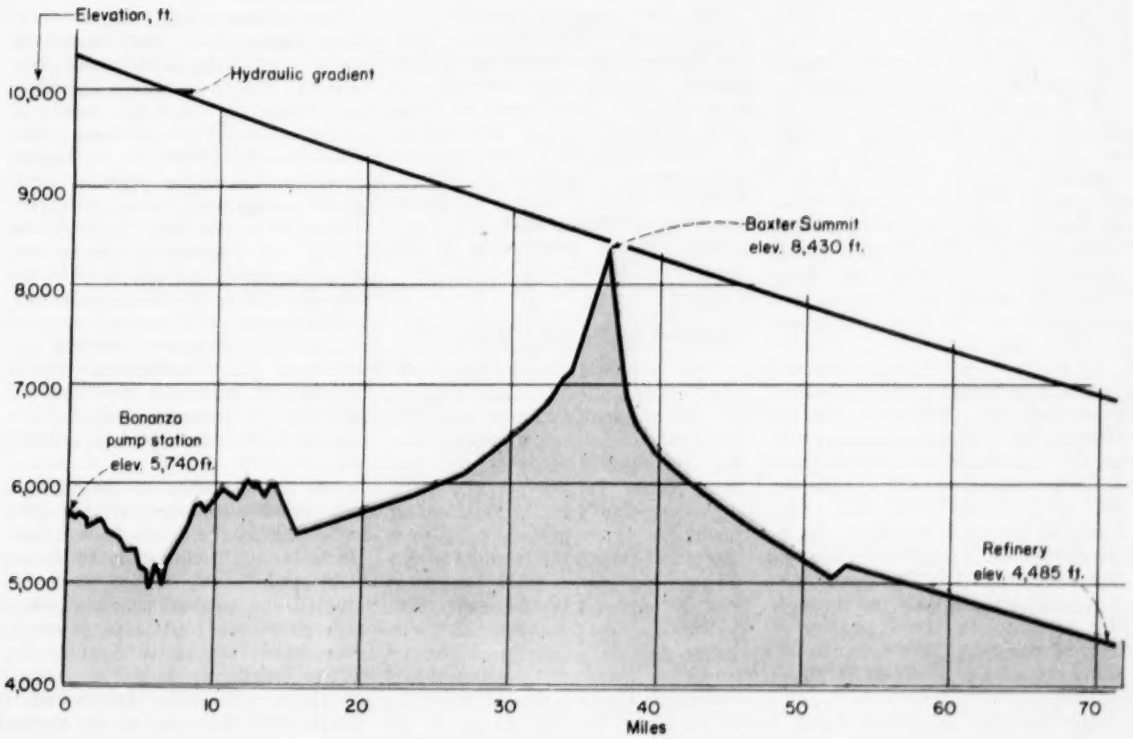
The 6-in. line is now successfully operating at the design tonnage flow rate of 700 tons per day. Our original concepts based on the test data can now be critically analyzed by comparison with operating data to see how accurate our interpretations of these tests were. Although our knowledge and experience are restricted to an unusually light solid, our observations should be of interest to those considering other solids-handling pipelines, and particularly to those designing facilities from pilot plant data.

Pressure Drop

The pressure drop with slurry in the commercial pipeline proved to be virtually the same as with clear water, and in close agreement with the pilot test data obtained at Golden, except that at Golden the pressure drop with clear water was slightly lower. Apparently the pipeline has a somewhat rougher internal surface, although both the pipeline and the test loop were constructed of "commercial grade" steel pipe. The pipe was obtained from different sources. The water pressure drop in the pilot loop was about that expected of smooth pipe, whereas the gradient in the pipeline is typical of that expected of steel pipe during the first year or so in water service. Surprisingly, the pressure drop of the slurry was not affected by the apparent difference in pipe roughness.

Pressure drop-flow velocity curves obtained in the pilot tests with gilsonite slurries having a wide range of solids concentration showed the same characteristic behavior found by many other investigators using solids of greater specific gravity. The pressure drop was found to be primarily a function of flow velocity, dropping to the values for clear water above a certain critical velocity.

This critical velocity has no pre-



DIFFICULTY of the terrain is indicated by this profile of the pipeline; note also the hydraulic gradient line (Fig. 1).

cisely defined value. Below it the pressure drop was considerably greater than for water. Size distribution of the solids in the slurry was found to affect the pressure gradient curves considerably. This can be seen from Fig. 2 on which are plotted friction factor-Reynolds number curves for various test runs at Golden. Reynolds numbers were calculated on the basis of water viscosity since we could not satisfactorily correlate data for slurry obtained on Stormer or Fann type viscosimeters.

The amount of minus 200-mesh particles in the slurry (most of them probably only a few microns in diameter) appears to be an important factor in establishing the pressure drop behavior. When large amounts of minus 200-mesh solids were present, the pressure drop in the test loop was found to be higher than water at velocities above the critical.

This was not the case with the "coarse" slurry which contained only relatively small amounts of minus 200-mesh sizes. The fines resulted from repeated pumping through the pilot test loop an equivalent distance of 72 miles. Perhaps the effective vicosity of the liquid adjacent to the pipe walls —where viscosity should have the greatest effect on pressure drop— is increased by a large concentration of fine particles. At flow velocities below the critical range, the coarse slurry showed a considerably higher pressure drop than the degraded slurry. Evidently, in this region some of the larger particle sizes are not maintained in suspension but drag along the bottom of the pipe and so obstruct part of the pipe's cross-sectional flow area.

In the test loop it was necessary to add a chemical dispersing agent to the slurry. Otherwise, the extremely fine gilsonite particles created by repeated circulation formed a sludge composed of fine gilsonite, air and water, and this soon plugged the loop. Air could not be completely eliminated from the system because the flow rate was measured by weighing the throughput at intervals. The viscosity effect of the dispersing agent on the slurry pressure gradient is shown in Fig. 2.

No chemical dispersing agent is required in the commercial installation since the slurry is relatively air free. One of the most important observations to be made here is that the results obtained in pilot-model loop tests can be very misleading. It was not possible to duplicate actual pipeline operation entirely in the small-scale equipment even though the pipe size and slurry flow rate were the same. Much of the pressure drop information obtained at Golden was of little value in establishing the final design because the results were affected greatly by the chemical dispersing agent and the excessive degradation of the solid particles in the system. These conditions are not significant in the operating pipeline, but nevertheless required careful evaluation.

Actual operation of the pipeline has shown that little or none of the pressure-drop safety factor provided in the design has been required thus far. However, more time will be necessary to determine the effect of pipe deterioration rate. Roughness should not increase greatly because the slurry particles would be expected to keep the pipe wall clean. If this does not occur, it may be necessary to run scrapers periodically. These scrapers will always be run in clear water.

The low pressure gradient observed so far in the operating line provides a highly desirable reserve of extra line capacity. Actually, the lower friction factor realized, along with a higher than anticipated volumetric efficiency for the constant-speed reciprocating pumps, combine to give a station discharge pressure not much below the maximum pressure anticipated in the design.

Attrition and Solids Recovery

The economic feasibility of the pipeline depended to a large extent on how much attrition or reduction in particle size would result from flow through 72 miles of pipe line. Such other factors as the pressure drop-flow velocity relationship could be extrapolated with some degree of reliability from data published for other solid materials, even though all were heavier than gilsonite. We realized that the quite friable gilsonite might become so attrited in transit that mechanical separation of the solids from the carrying water at the terminal would be virtually impossible. It was considered feasible to use gravity separation in the liquid phase after melting or dissolving the gilsonite directly from the water slurry, but this would have required even more expensive equipment.

The amount of particle size degradation, and its effect on the dewatering problem, was established by pumping slurry through the 500-ft. pipe test loop at Golden. Slurry was continuously circulated through the loop by a slow-speed solids-handling centrifugal pump, until the slurry had traveled the equivalent of 72 miles. Large amounts of fine material were generated in the circulating system, but dewatering by vacuum filtration proved possible, even though the water content of the filter cake was rather high.

Tests were also run with a short-circuited pump in an attempt to determine the degradation due to the pipe loop alone, since we suspected that the centrifugal pump caused most of the solids degradation. However, the test results were inconsistent. An air lift was substituted for the centrifugal pump, but again the attrition in the system was masked by the propelling equipment.

This uncertainty might have been resolved by more elaborate tests, but it appeared more economical simply to design the filter equipment for the high degree of attrition found in the tests. This was almost certain to be higher than would be experienced in actual pipeline operation where the slurry makes only one pass through the pump. If degradation were less than assumed, the efficiency of the vacuum filters at the pipeline terminal would be improved and the filter cake moisture thereby decreased. Since mechanical drying equipment was not necessary at the pipeline terminal, this decision added little to the plant investment cost.

Actual operation of the pipeline has since demonstrated that little attrition occurs in the 72-mile line. Only a slight increase in minus 200-mesh particles has been detected and most of this we believe occurs in the 1½-in.-pipe pressure-breakdown section at the terminal. This breakdown holds an 800-psi. backpressure in the line to keep it filled with slurry up to its highest point at Baxter Summit. Filter cake moistures of from 14 to 16%

have been experienced, rather than the 20% provided for in the design.

Minimum Flow Velocity

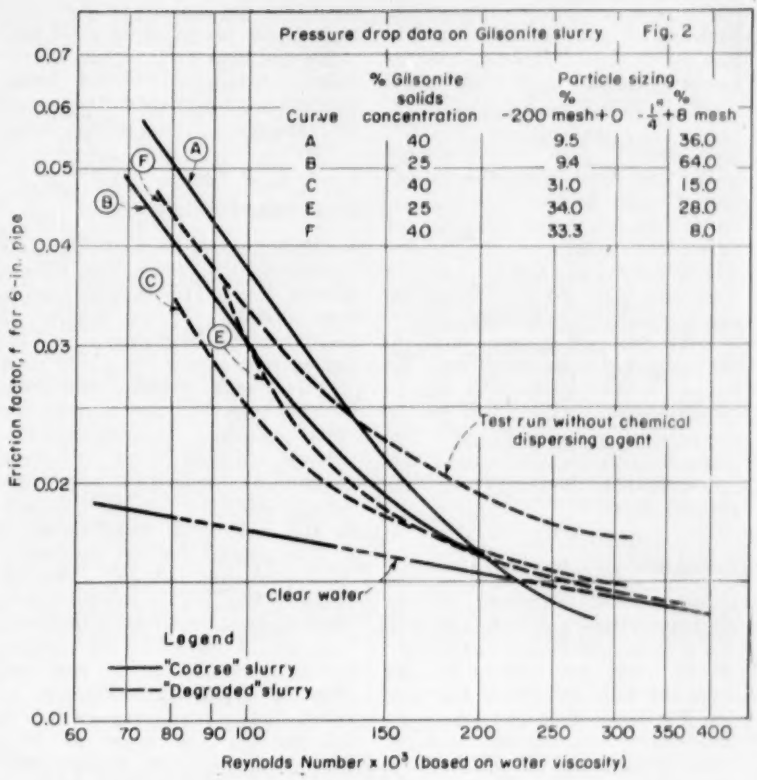
The primary criterion for design of the pipeline was that the flow velocity should be above the minimum necessary to keep the particles in complete suspension so that the entire cross section of the pipe would be effective for flow. Under this condition there should then be little chance of solids depositing in the line, particularly in dips or swales. Fortunately, since gilsonite is an unusually light material, the 3.4 fps. velocity selected is in the range commonly used for conventional pipelines where flow velocity is determined only by economics. This velocity is roughly 20 times the settling velocity in water of the larger particles contained in the slurry.

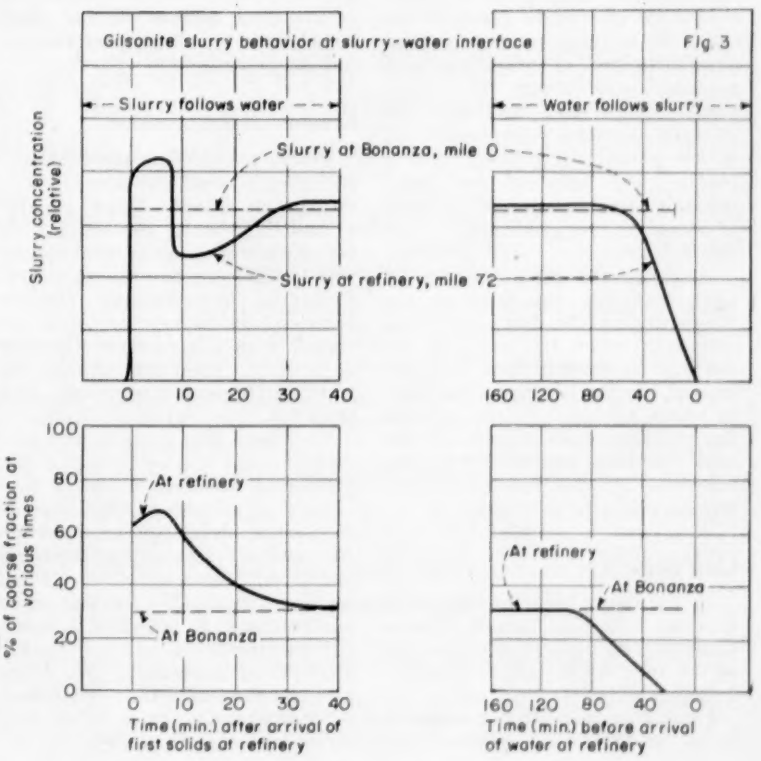
At Golden, some larger particles of gilsonite were tagged with a radioactive tracer in order to determine their actual velocity and thus be certain that the minimum velocity selected was adequate to carry all of the solids in suspension. These relatively large particles, some ⅜ in. in diameter, were found to travel at velocities that were at least equal to and usually higher than the smaller particles in the slurry.

The same type of behavior has also been observed in the operating pipeline. Unexpectedly, the leading water-slurry interface of several batches showed a significant increase in solids concentration over the average for the batch. The solids increase in this zone was due to an accumulation of larger size particles as can be seen from Fig. 3.

We observed this in the first slurry samples taken from the batch as it arrived at the termination point. Immediately following the approximately 1,000-ft. long leading slug of the higher-concentration coarse slurry, the concentration fell below the batch average for the following 1,000 ft. or so.

Apparently there is a tendency for the coarse particles to travel at the center of the pipe where the velocity is slightly higher than average. However, the particles do not continue to travel faster than the average when they reach the more dilute part of the leading interface, but congregate in a short section.





A hypothesis to explain this phenomenon is that a large particle leaving the central higher-velocity region is thrown back towards the center by virtue of the spin which is acquired in traveling into the lower-velocity flow near the pipe wall. The reason for the "void" immediately behind the concentrated slug of coarse solids is not fully understood.

The interfaces shown in Fig. 3 were purposely cut sharply at the pump station by suddenly switching the two pumps from water to slurry in order to observe its behavior in the pipeline. In regular operation, slurry concentration in the pipeline is now built up in two steps in order to avoid undesirable concentration increases as explained above.

Accumulations in the Pipeline

Gilsonite is inherently a very pure hydrocarbon, but in the mining process which uses a 2,000-psi. jet of water for cutting the ore from the vein, some rock and sand are inevitably dislodged and enter the slurry preparation facilities. Here all sand over 50 mesh is removed in continuous settling tanks. Sand smaller than minus 50 mesh cannot be completely removed because its settling velocity is comparable to that of larger gilsonite particles in the slurry. There was some concern that sand or large gilsonite particles might settle out at low points along the line so a rubber cup scraper was sent through after the first three days of operation. No accumulation was found.

Actually, the small amount of sand that was entrained in the slurry during the first continuous operation, when the complete desanding equipment had not yet started functioning, had a tendency to travel slower than the average flow velocity even though all the sand particles had lower settling velocities in still water than the largest gilsonite particles.

Line Capacity

It has now been demonstrated that the 6-in. pipeline can successfully transport gilsonite at the rate of 700 tpd., which is the initial refining rate.

From a pressure drop standpoint, based on the Golden tests we believe that the capacity of the pipeline can be increased to 1,000 tpd. using the present pumping equipment. Installation of an intermediate booster-pump station would increase the capacity to more than 1,700 tpd.

Maximum Particle Size

Pilot pumping tests conducted at Braddock, Pa., with the Wilson Snyder Pump Co., showed that it was possible to pump slurries of fairly high concentration with ¼-in. top particle sizes. The pump used was a standard model piston pump commonly used in the oil fields for "mud pumping." However, the volumetric efficiencies observed were substantially less than with clear water. When the top particle size in the test batch was limited to 8 mesh, much higher volumetric efficiencies were obtained, so top particle size in the pipeline was limited to approximately 8 mesh.

In actual operation, the pipeline pumps operate at only 37 rpm. and show a volumetric efficiency of about 96% with slurry—which is substantially the same as with water. These are four-cylinder plunger-type mud pumps, equipped with spherically seated steel valves of standard design. So far, they have given excellent performance in this service.

Erosion and Corrosion

Unlike many ores, gilsonite will not abrade steel surfaces to any measurable extent. Hence, no significant allowance for erosion or corrosion was made in establishing wall thicknesses for the pipe line. Following conventional pipeline practice, the slurry line was designed with a pipe wall stress of 65% of the yield strength of the steel, although the minimum wall thickness was limited to ⅜ in.

To assure that erosion and corrosion would not be problems, the California Research Corp., a subsidiary of Standard Oil Co. of California, developed an interesting method for quickly determining metal wall losses by using a small section of pipe in the test loop made radioactive in an atomic pile. Careful measurement of the minute amounts of radioactive iron worn away by the slurry thus established corrosion-erosion rates after only a few hours of circulation.

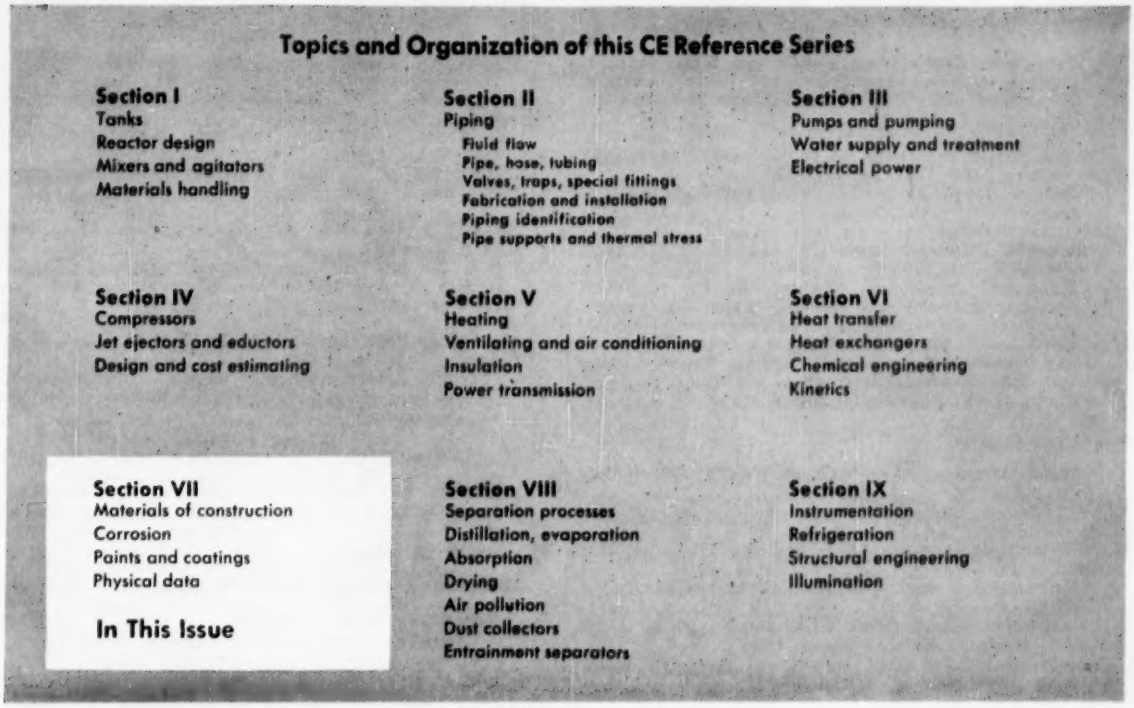
Even though gilsonite is not believed to be significantly erosive, a conventional chemical corrosion inhibitor must be used to prevent corrosion of the line by dissolved oxygen in the water. If no inhibitor were used, corrosion rates would be extremely high because the solids scour away the oxide film as fast as it forms.

Continuity of Flow

The pipeline was designed for continuous flow and for shut-down only after all slurry had been flushed from the system. Three motor-driven slurry pumps are provided at the pump station, any two of which can maintain the established minimum flow. This permits one unit to be down for maintenance. In the event of a power outage, a diesel-driven water pump capable of flushing the system with water at the required flow rate will be automatically cut into the pipeline so as to maintain uninterrupted flow. As a further precaution against having to shut down with slurry in the system, we provided a water reservoir capable of flushing out the entire line at the high point of the pipeline at Baxter Summit.

Pilot tests had showed that under most circumstances the test loop could be shut down with slurry remaining in the pipe, yet we could still restore the flow. However, in some cases the loop became plugged. Our test program was not extensive enough to determine why. We felt it safer therefore to provide for continuous operation in the full-scale pipeline insofar as possible. Fortunately this was feasible at nominal expense.

We feel that there is a great potential for pipeline transport of solids, especially where large tonnages are to be handled or other means of transportation are impractical or too costly. In the case of the gilsonite pipeline we were dealing with a unique material of low specific gravity and the factors controlling design were few. All cases require very careful analysis of many factors and it is possible that designing for other solids would require an entirely different approach. Nevertheless, we believe that the design described here has made an important contribution to the new science of solids transport by pipeline.



Your Design Reference File—VII

Continuing our series, here are more references to add to your files. Use them to help you find information on materials of construction, corrosion, paints, coatings and physical data.

RALPH CUSHING, Senior Process Engineer, Mobay Chemical Co., St. Louis, Mo.*

Materials of Construction

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* For author biography see *Chem. Eng.*, Sept. 1957, p. 341.

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Furfural Alcohol

"Furfural Alcohol as a Resin Former," E. A. Reineck, *Modern Plastics*, Oct. 1952.
Description of production and applications; furfural cements; physical properties and chemical resistance; coatings; adhesives.

Polyester—Laminates

"Plastics Equipment Reference Sheet," Seymour, R. B., and R. H. Steiner, *Chem. Eng. Progress*, Aug. 1952, p. 430.
Polyester-glass laminated plastics; corrosion resistance; mechanical and physical properties.

"Reinforced Polyester Plastics," Seymour, R. B., and R. H. Steiner, *Chem. Eng.*, Dec. 1952, pp. 278-286.
Corrosion resistance; physical properties; forms available; applications.

Polyethylene

"A New Material: Irradiated Polyethylene," Bockhoff, F. J., and J. A. Neumann, *Chem. Eng.*, Sept. 1955, pp. 228-234.
Heat resistance; mechanical properties and solvent resistance; electrical properties; application.

"The New Polyethylenes and Their Impact on Fabricated Parts," Neumann, J. A., and F. J. Bockhoff, *Modern Plastics*, Aug. 1 1955.
Properties, fabrication methods; application methods; irradiation.

"Chemical Resistance of Polyethylene Resins," *Chem. Processing*, July 1955, p. 80.
Chemical resistance.

"Plastics Equipment Reference Sheet," Seymour, R. B., and R. H. Steiner, *Chem. Eng. Progress*, Sept. 1952, p. 478.
Chemical resistance; mechanical and physical properties.

"Polyethylene," J. L. Huscher, *Chem. Eng.*, Oct. 1952, pp. 260-268, 276, 277.
Corrosion resistance; physical properties; available forms; applications; fabrication methods.

Polyvinyl Chloride

"Plastic Pipe for Underground Structures," Seymour, R. B., *Corrosion*, July 1955, pp. 50-55.
Tabulated data given on the physical properties of pipe made from epoxy-glass, polyester-glass, cellulose acetate butyrate, polyethylene, styrene rubber and PVC as to specific gravity, structural properties, chemical resistance vs. a number of chemicals; a specification for an ideal pipe line; engineering characteristics of corrently used plastic pipes.

"How Polyvinyl Chloride Tape is Used in Corrosion Mitigation Programs," A. C. Kilberg, *American Gas Journal*, April 1955, pp. 14-15.
Effect, results, preparation; installation; costs.

"Unplasticized Polyvinyl Chloride," J. L. Huscher, *Chem. Eng.*, Nov. 1952, pp. 264-280.
Corrosion resistance to a number of corrosives; physical properties; methods of fabrication.

"Plastic Equipment Reference Sheet," Seymour, R. B., and E. A. Erich, *Chem. Eng. Progress*, July 1952, p. 374.
Corrosion resistance and physical properties.

Saran

"Preventing Corrosion With Saran," M. M. Hoover, *Chem. Eng.*, July 1954, pp. 264-272.
Physical properties; fabrication; application; available forms.

"Plastics Equipment Reference Sheet," Seymour, R. B., and R. H. Steiner, *Chem. Eng. Progress*, Oct. 1952, p. 534.
Saran: physical and mechanical properties; corrosion resistance.

Styrene Copolymers

"High Impact Styrene Copolymers," Seymour, R. B., and R. H. Steiner, *Chem. Eng.*, Jan. 1953, pp. 254-262.
Corrosion resistance; mechanical and physical properties; forms available; applications.

"Plastics Equipment Reference Sheet," Seymour, R. B., and R. H. Steiner, *Chem. Eng. Progress*, Nov. 1952, p. 586.
High-impact styrene copolymer; corrosion resistance and physical properties; mechanical properties.

Teflon and Kel-F

'Polytrifluorochloroethylene for Corrosive Service," J. A. Jupa, *Chem. Eng.*, June 1954, pp. 272-278.
Properties; physical and mechanical; fabrication methods; forms available; chemical resistance and dimensional stability.

"Kel-F, Physical, Electrical, Chemical and Mechanical Properties," M. W. Kellogg Co., *Technical Bulletin #1-3-53*, p. 1.
Chemical structure; general properties; physical and electrical properties; chemical resistance and dimensional stability.

Corrosion

General

"Corrosion Resistance Chart," Turn Tube Plastics, Inc., *TTP 118R-5-355*, 1955.
Chemical resistance chart for the following materials; PVC, copper and bronze; monel, stainless steel types, aluminum.

"Corrosion Inhibitor Checklist," Maxey Brooke, *Chem. Eng.*, Dec. 1954, pp. 230-234.
Inhibitors for a variety of materials in several environments.

"Nomographs for Making Corrosion Rate Calculations," W. A. Szymanski, *Corrosion*, May 1954, pp. 422-424.
A nomograph is described and illustrated which facilitates making corrosion rate calculations. This nomograph can be used to convert corrosion rates expressed as mg./sq. dm./day to in. penetration/yr.

"Corrosion Information Service," Int. Nickel Company Inc., *5M-11-47*, Nov. 1947.
Corrosion by concentration cells; metal-ion cells; aeration cells; oxygen-cells; rules for minimizing or preventing concentration cell corrosion.

"Glossary of Corrosion Terms," *Chem. Ind.*, April 1947, pp. 618-620.
A list helpful definitions.

Chemical Attack

"Mixed-Acid Corrosion," L. R. Scribner, *Chem. Processing*, Dec. 1954, pp. 84-92.
Corrosion resistance of several materials to mixtures of sulfuric, and nitric acids and water; also resistance of ferrous alloys and plastics to several acids and alkalies.

"Combating Corrosion From Industrial Chemicals," George Shaffer, *Ind. and Power*, July 1952, pp. 77-90.
Resistance charts for a variety of chemicals on ferrous metals, plastics, and miscellaneous materials of construction; correction factors for presence of dissolved air, slurry, agitation. Material reference chart; when no defnite corrosion data are available this material reference chart indicates suitable metals to employ.

"Corrosion by Some Organic Acids and Related Compounds," H. O. Teeple, *Corrosion*, Jan. 1952, pp. 14-28.
The results of corrosion tests in various organic acids. Aqueous solutions of the acids and mixtures are considered; aldehydes, ketones, esters and anhydrides are discussed. The materials of construction discussed are the ferrous and nonferrous alloys.

Cathodic Protection

"Cathodic Protection With Zinc Anodes," a report prepared for the American Zinc Institute by Ebasco Services Inc., June 1953.
Corrosion of underground structures and cathodic protection; properties of zinc anodes; cathodic protection of steel distribution piping systems; transmission pipe lines; design of zinc anode systems: heat exchangers and condensers; underground lead sheathed cables; water storage tank risers; zinc anodes in water; zinc anodes as grounding electrodes.

"Cathodic Protection Can Save Chemical Process Equipment," L. P. Sudrabin, *Chem. Eng.*, May 1953, pp. 196-200.
Applications on chemical process equipment; anode selection; application on radiant heating.

"Cathodic Protection Links Corrosion," L. C. Werkin, *Pet. Refiner*, Oct. 1952, pp. 122-124.
Definition of cathodic protection; overdesign and corrosion allowances; product losses; maintenance.

"Cathodic Protection," J. F. Hirshfeld, *Heating, Piping and Air Cond.*, Oct. 1952, pp. 104-109.
Corrosion prevention by cathodic protection; how it works, where it is used, what savings are possible, why it's important; corrosion caused by soil differences, by variation in moisture content, by impurities in surface of pipe; galvanic cell; dissimilar metals; costs; savings.

Underground Corrosion

"Economic Considerations of Corrosion Control on Underground Piping-Rectifiers vs. Galvanic Anodes and Other Details of Cathodic Protection," A. W. Peabody, *Gas*, Aug. 1955, pp. 47-51.
Economic considerations of corrosion control of underground piping; effect of anode spacing on number of anodes; costs of cable and right of way; ground bed resistance vs. costs.

"Economic Considerations of Corrosion Control on Underground Piping," A. W. Peabody, *Gas*, July 1955, pp. 45-49.
Pipe materials; coating qualities vs. cathodic protection; overall costs.

"Use These New Techniques In . . . Avoiding Underground Corrosion," O. C. Mudd, *Pet. Refiner*, June 1954, pp. 172-74.
Anodic metal for electrical grounds; galvanizing to conserve protective current; electrical current drainage bonds; surge arresters on flanges.

"Stop Corrosion of Buried Pipes . . .," *Power*, Jan. 1954, pp. 109-114.
The use of PVC tape to reduce corrosion by soil chemicals, stray ground currents, soil bacteria and fungi; application of the tapes.

"Fighting Underground Corrosion at the New Fairless Works," Coleman, W. E., and H. G. Frostick, *Heating, Piping and Air Cond.*, April 1953, pp. 85-87.
Elimination of bare copper underground for reduction of galvanic corrosion; magnesium anodes protect steel ground rods, underground piping, lead cables and foundations; insulating coverings on pipes reduce need for cathodic protection; design of ground bed installations.

Paints and Coatings

Selection

"A Primer on Protective Coatings," R. B. Seymour, *Organic Finishing*, Mar. 1953, pp. 9-15.
Surface preparation; material selection; coverage; application; wash primer; continuity tests.

"How Protective Coatings Fight Corrosion," Kenneth Tator, *Chem. Eng.*, Dec. 1952, pp. 143-190.
Organic materials vs. corrosion; classification of types; forms available; application and advantages of types outlined; costs; inspection; specification; techniques of application and maintenance; chemical resistance; directory of trade names and producers.

"Four Steps to Better Coatings," Kenneth Tator, *Chem. Eng.*, Mar. 1950, pp. 223-226.
Ten basic types presented; film thickness; test panels.

Metallic Paints

"Here's Low-Down on Aluminum Paint," M. C. Davis, *Power*, Dec. 1952, pp. 123-125.

Surface preparation; atmospheric conditions desirable for painting; primers; application; maintenance.

Chemical Resistance of Coatings

"Corrosion Keys Surface Coatings," Karl Bennung, *Chem. Processing*, July 1955, pp. 74-76.
Chemical resistance of neoprene, vinyl, epoxy, hypalon against inorganic acids; graphic form.

"Plastics Equipment Reference Sheets," Seymour, R. B., and R. H. Steiner, *Chem. Eng. Progress*, Dec. 1952-Sept. 1953.
Application, composition, temperature limitations, mechanical and physical properties, corrosion resistance for the following coatings.
Furane cement, Dec. 1952, p. 650.
Phenolic cement, Jan. 1953, p. 52.
Plasticized vinyls, June 1953, p. 330.
High styrene-butadiene copolymer coatings, July 1953, p. 390.
Chlorinated rubber coatings, Aug. 1953, p. 452.
Neoprene rubber, Sept. 1953, p. 510.

Organic Coatings

"Using the Epoxy Resins," C. V. Wittenwyler, *Chem. Eng. Progress*, Feb. 1956, pp. 53F-56F.
Properties; coatings; comparison with other coatings; laminates; comparison of reinforced plastics; epoxy coatings; adhesives.

"Organic Coatings Indicator Chart," Kenneth Tator, *Chem. Eng. Progress*, Oct. 1955, p. 64.
Zinc-rich coatings; silicones; thermosetting plastics; rubbers; plastics.

"Organic Coatings Indicator Chart," Kenneth Tator, *Chem. Eng. Progress*, Aug. 1955, p. 40.
Indicator chart giving numerical rating to coatings for physical and chemical resistance; to be used as a basic preliminary selection aid.

"Epoxy for Cements and Coatings," Seymour, R. B., and R. H. Steiner, *Chem. Eng.*, April 1954, pp. 224-252.
Mechanical, physical and chemical properties; chemical resistance.

"Some Newer Organic Protective Coatings," David Busker, *Product Eng.*, Aug. 1952, pp. 167-174.
Recent developments in the protective coating field; properties of resin base finishes; applications; specialty finishes; strippable films.

Mastics and Thick Coatings

"Plastisols—Muscle Men in War on Corrosion." D. R. Meserve, *Plant Eng.*, Feb. 1956, pp. 114-115, 200.
Description; uses; application; chemical resistance.

"Guide to the Use of Mastic Coatings," F. M. Kennedy, Jr., *Plant Eng.*, June 1954, pp. 100-101.
Preconditioning of surface; selection; application procedure.

"Coating With Mastics," Seymour, R. B., and R. H. Steiner, *Chem. Eng.*, May 1954, pp. 232-242.
Surface preparation; composition; application; rating based on corrosion resistance in chemical atmospheres.

"Why Go to Thick Protective Coatings?," R. R. Pierce, *Chem. Eng.*, April 1954, pp. 177-181.
Evaluation procedure; coating thickness; selection; hard to coat areas; sources of failure.

Hot Spray

"Corrosion Control's New Tool—Hot Spray Painting Equipment," *Plant Eng.*, Dec. 1955, p. 95.
Description of equipment and method.

"Hot Spray Smooths Out Rejects," *Steel*, Jan. 24, 1955, p. 82.
Methods; advantages; costs.

"Hot Spray Application of Vinyl Paints," B. C. Wright, *Paint and Varnish Production*, Oct. 1954, pp. 30-32, 82.
Application; evaluation equipment; cost field tests.

Miscellaneous and General

"Paint Tips For Plant Engineers," Kut, David, and S. Kut, *Plant Eng.*, May 1956, pp. 94-95.
Article discusses characteristic components of typical paints and tells what each of these is supposed to do. Driers; final product preparation; film formation.

"Paint Galvanized Surfaces?," *Factory Management and Maintenance*, April 1956, pp. 108-109.
Causes of peeling paint; how to avoid peeling; surface preparation; application.

"What You Should Know About Specifying Paint Protection," T. J. Eberhardt, *Ind. and Power*, April 1956, pp. 45-46.
Shop coat; pigment; costs compared with alloys.

"Before Treating Steel Surfaces: Check These Test Results for Preparations to Fit Your Problem," C. H. Laing, *Plant Eng.*, Mar. 1956, pp. 108-110.
Description of surface preparation; paint systems applied and test results.

"Proper Design for Painting," Kirtley, H. G., and W. G. Colter, *Chem. Eng.*, Feb. 1956, pp. 187-192.
The effect of paintability on equipment design; surface shape; surface accessibility; materials; costs; fabrication details; structural framing; walls; windows; wooden structures; piping; tanks; fasteners.

"What Paint Roller Cover Where?," *Plant Eng.*, Feb. 1956, pp. 88-91.
Recommended roller covers for use on various surfaces when using different types of interior and exterior paints.

"The Measurement of Color and Gloss," R. S. Hunter, *Product Eng.*, Feb. 1956, pp. 176-182.
Definitions and the derivation of gloss and color scales; color and gloss instrumentation; appearance.

"Evaluating Physical Properties of Coatings," J. I. Richardson, *Chem. Eng.*, Nov. 1955, pp. 242, 244, 248.
Permeability; thickness; adhesion; flexibility.

"Specifying Paint Protection," W. D. Palmer, *Ind. and Power*, Feb. 1955, pp. 47-50.
Surface preparation; paint quality; application methods; maintenance and repair costs; primers; finish coats; scheduling; paint costs.

"Spray Coatings, Better Faster Way to Apply Adhesives," G. A. Newman, *Factory Management and Maintenance*, Sept. 1954, pp. 138-140.
Advantages; application; solvents; drying time ratio; spray equipment; water-dispersed adhesives.

"Key to Savings in Painting Costs," R. R. Pierce, *Chem. Eng.*, May 1952, pp. 149-153.
Number of coats; coat thickness; build per coat; applied costs; inspection and touch up; evaluation and inspection.

"Dow Draws Conclusions From Three-Year Paint Study," O. K. Sieplein, *Chem. Eng.*, Oct. 1950, pp. 110-115.
Description of a 3 year paint test study; color retention of colored pigments; exposure areas; finish coats; gloss rating; chalk rating; protection rating; primers; vinyls and styrene.

Physical Data

Thermodynamic Properties

"Thermodynamic Properties of Freon-12 Refrigerant (Dichlorodifluoromethane)," E. I. duPont deNemours & Co. Inc., *A-973*, 1956.

Mollier chart; superheated data; saturated data; physical properties.

"'Kinetic' Technical Bulletin," E. I. duPont deNemours & Co., Inc., *RT-11*, May 1954.
General characteristics, chemical, physical and thermodynamic properties of Freon-12, comparative data for Freon-11, Freon-22, Freon-113 and Freon-114. Materials of construction data; trouble shooting; leak detection; accessories.

"'Freon' Compounds for Use as Refrigerants, Propellants and Other Applications," E. I. duPont deNemours & Co., Inc., *'Kinetic' Technical Bulletin B-2*, 1954.
General characteristics; chemical and physical properties; physiological action; applications; vapor pressure data.

"Two Gaseous Mixtures Containing Hydrogen and Nitrogen," Sage, B. H., R. H. Olds, and W. N. Lacey, *Ind. & Eng. Chem.*, Aug. 1948, pp. 1453-1464.
Thermodynamic properties of a mixture of hydrogen and nitrogen and of a five component mixtures of hydrogen, nitrogen, carbon dioxide, carbon monoxide and methane at pressures of 15,000 and 10,000 psi. respectively at temperatures from 40 to 460 F. Volume, entropy and enthalpy given; graphical and tabular presentation.

Vapor-Liquid Equalibria

"Vaporization Equilibrium Constant and Activity Coefficient Charts," Smith, K. A., and R. B. Smith, *Pet. Processing*, Dec. 1949, pp. 1355-1360.
Series of charts; fugacity coefficients; equilibrium constants for hydrocarbons; equilibrium constants for paraffin hydrocarbons at total system of 14.7 to 10,000 psia.; volatility index for paraffin hydrocarbons; vapor and liquid phase activity coefficients.

"Composition of Vapors From Boiling Binary Solutions," D. F. Othmer, *Ind. & Eng. Chem.*, May 1943, pp. 614-620.
Detailed dimension drawings are presented of a simple unit for determining the composition of vapors resulting from boiling solutions of binary liquids; various factors are discussed with relation to the technique; vapor-liquid equilibra data for twenty six binary systems are reported.

"Vapor-liquid Equilibria for Commercially Important Systems of Organic Solvents," Brunjes, A. S., and M. J. P. Bogart, *Ind. & Eng. Chem.*, Feb. 1943, pp. 255-260.
Vapor-liquid and activity coefficients for combination binary and ternary systems involving ethanol, butanol, acetone, isopropanol and water; observations on the operation of commercial distillation equipment.

Thermal Conductivity

"Thermal Conductivity Chart for Gases," Johnson, A. I., and Chen-Jung Huang, *Chem. Eng.*, Feb. 1954, pp. 204-205.
Nomographic solution based on specific heat and viscosity.

Vapor Pressure

"Vapor Pressure Data II," Fader, Bruce, and Frank McElroy, *Chem. Processing*, April 1956, pp. 74, 76.
Alignment charts for several solvents.

"Vapor pressure Data," Bruce Fader, *Chem. Processing*, April 1955, pp. 72, 74.
More data on solvents and petrochemicals; nomograph.

"Vapor Pressure of Water and Temperature Conversion Chart," K. A. Kobe, *Pet. Refiner*, May 1953, p. 173.
Vapor pressure of water in English or metric units at any temperature from freezing to boiling.

"Vapor Pressure of Various Materials," Ernst Berl, *Chem. & Met. Eng.*, Oct. 1944, pp. 132, 133.
Vapor pressures of various materials from −200 to 240 C; organic and inorganic materials.

Pressure

"Pressure-Fundamentals," *Pet. Processing*, Jan. 1956, pp. 101-102.
Pressure conversion chart; basic theory and definitions.

"Pressure Conversion," C. H. Blauch, *Chem. Processing*, Jan. 1953, p. 172.
Feet of liquid vs. psi.; alignment chart.

Temperature

"Temperature-Fundamentals," *Pet. Processing*, Feb. 1956, pp. 101-102.
Basic theory and definitions; temperature conversion chart.

Compressibility

"Compressibility Nomograph for Low Pressure," D. S. Davis, *Chem. Processing*, Oct. 1955, p. 254.
Alignment chart solution.

"Generalized Compressibility Charts," Nelson, L. C., and E. F. Obert, *Chem. Eng.*, July 1954, pp. 203-208.
Five generalized charts developed from the averaged data for 30 gases. New charts are superior in accuracy to older charts. Separate enlargements of 5 sections of the chart improve accuracy.

Volumes

"Correcting Gas Volumes to Standard Conditions," Noddings, C. R., and R. M. Lawless, *Chem. Processing*, May 1955, pp. 200-202.
Alignment chart.

"How to Predict True Volumes in Blending," E. J. Reeves, *Pet. Refiner*, June 1954, pp. 137-139.
A method for predicting true volumes; examples and discussion of method.

"Charts Solve Polytropic P-V-T Relations," W. T. Rice, *Chem. Eng.*, April 1950, pp. 120-122.
Charts that aid and simplify the P-V-T relations and related calculations.

Viscosity

"Aid for Estimating Viscosity of Blends," D. S. Davis, *Chem. Eng.*, Mar. 1956, p. 214.
A simple graphical method for calculating viscosity of blends of materials of different viscosities.

"Viscosity of Gases," Mapstone, G. E., and J. T. Munday, *Chem. Processing*, Feb. 1955, p. 204.
Alignment chart.

"Viscosity of Sulfuric Acid," D. S. Davis, *Chem. Processing*, Mar. 1955, p. 188.
Alignment chart.

"Chart for Getting Vapor Viscosities," Johnson, A. I., Chen-Jung Huang and J. D. Kemp, *Chem. Eng.*, Dec. 1954, p. 195.
Graphical solution from vapor temperature, molecular weight, critical temperature and pressure.

"Quick Viscosity Conversion," *Chem. Processing*, Dec. 1953, p. 64.
Viscosity conversion chart.

Activity Coefficients

"Effect of Temperature on Liquid Phase Activity Coefficients," Berg, Clyde, and A. C. McKinnis, *Ind. & Eng. Chem.*, July 1948, pp. 1309-1311.
Experimental data on ethanol-water and ethanol-acetylene systems; equations and correlations.

Absorption and Adsorption Factors

"Adsorption Isotherms for Pure Hydrocarbons," Koble, R. A., and T. E. Corrigan, *Ind. & Eng. Chem.*, Feb. 1952, pp. 383-387.
Data, equations and correlations.

"Nomograph for Determination of the Edmister Effective Absorption Factors," G. E. Mapstone, *Chem. Ind.*, April 1948, pp. 638-642.
Alignment chart.

Density

"Specific Gravity of Some Organic Acid," D. S. Davis, *Chem. Processing*, June 1956, p. 216.
Nomograph.

"More Data to Aid Design—Liquid Densities Over Temperature Range," J. O. Osburn, *Chem. Eng.*, Mar. 1956, pp. 196-198.
Nomograph to convert density data at room temperature to densities at higher temperatures.

"Chart Gives Aqueous Ammonia Densities," A. M. P. Tans, *Chem. Eng.*, Oct. 1955, p. 218.
Nomograph solution.

"Density of Methanol-Water Solution," *Chem. Processing*, April 1953, p. 38.
Nomograph.

"Density of Sodium Hydroxide in Concentrated Solution," *Chem. Processing*, Mar. 1953, p. 218.
Nomograph.

Heat Capacity

"Heat Capacity of Organic Liquids," Chow, W. M., and J. A. Bright, Jr., *Chem. Eng. Progress*, April 1953, pp. 175-179.
A correlation predicting the heat capacity of liquids as a function of structural parachor and molar refraction values; a proposed relationship between heat capacity and expansion factor making possible the prediction of heat capacities at any condition from a single known value.

Solubility

"Solubility of Ammonia in Water," D. S. Davis, *Chem. Processing*, June 1956, p. 222.
Nomograph.

"Solubility Data for Alcohols," *Chem. Processing*, Sept. 1954, p. 204.
Tabular data for twentyfour alcohols as a solution in some 18 solvents.

Flow

"Flow Rate Conversion," Robert Hlavin, *Chem. Processing*, Mar. 1954, p. 188.
Gallons per minute to pounds per hour; nomographic.

Miscellaneous

"Alkali Equivalents," Bruce Fader, *Chem. Processing*, April 1956, p. 80.
Alkalie equivalents for NaOH, Soda ash, dolomite, $CaCO_3$, NH_3 and NH_4OH.

"Corrections for Saturated-Steam Flowmeters," S. A. Sewall, *Power*, Dec. 1955, p. 109.
Graphical chart to determine correction factor for flows read at other than design conditions.

"Nomograph for Computing Standard Deviations," D. S. Davis, *Chem. Processing*, July 1953, pp. 48a-48b.
Nomographic solution.

"Estimating Pipe Wall Thickness," Halfaker, J. J., and J. E. Myers, *Chem. Processing*, June 1953, pp. 45a-45b.
Nomographic solution.

"Handy Table Of Rope Sizes and Strengths," *Power*, May 1953, p. 111.
Wire cable sizes and strengths; care and maintenance.

"Ignition Temperatures for Vapors and Gases," J. D. Constance, *Power*, May 1953, p. 105.
Some 25 materials listed giving ignition temperatures.

"Curves Cut Work in Determining Electric Energy for Heating," Joseph Gialanella, *Chem. Eng.*, May 1953, p. 234.
A chart for quick estimation of the energy requirements for electrically heating liquids or solids.

Physical Data for Specific Chemicals

"Propylene Glycol," Carbide and Carbon Chemical Company, *F-8738*, April 1955.
Physiological properties; physical properties; solubilities; constant boiling mixtures; specific gravities; boiling points; freezing points; density; heats of vaporization.

"Acetone," Celanese Corp., *Bulletin S-02-S*, 1955.
Physical properties; specifications; shipping and handling.

"Acetone," Carbide and Carbon Chemicals Company, *F-8650*, Dec. 1954.
Physical properties; boiling points of azeotropes; vapor pressure; specific gravity; surface tension; viscosity; liquid vapor equilibria.

"Properties of Ketones," *Chem. Processing*, Feb. 1954, p. 198.
Vapor pressures; nomographic form.

"Alcohol Data," Bruce Fader, *Chem. Processing*, Sept. 1954, p. 202.
Vapor pressures; nomographic form.

"Alcohols," Carbide and Carbon Chemicals Company, *F-4731B*, 1954.
Physical properties; specific gravities; specific heats; freezing points; solubilities in water; azeotropes; viscosities; specifications and test methods.

"Methanol," Carbide and Carbon Chemicals Company, *F-8141*, April 1954.
Physical and physiological properties; storing and handling; vapor pressure; specific gravity; freezing points; surface tension; density; heat capacity; solubilities; viscosity; refractive index; azeotropes.

"Methanol, CH_3OH," Commercial Solvents Corporation, *TDS. New Series No. 6*, May 31, 1952.
Specifications; physical properties; chemical properties; toxicity; chemical properties; shipping, handling etc.

"Methanol," Commercial Solvents Corporation, *Form #1C-5406-2-3M*, 1952.
Chemical properties; physical properties; safety; handling and storage; specification and test methods; density, viscosity, heat capacity, surface tension, azeotropes; thermodynamic properties of methanol; properties of methanol water solution; freezing points; heat of solution; thermal conductivity; nomograph for increasing concentration of methanol water solutions.

"The Viscosity, Thermal Conductivity and Specific Heat of Dry Air at Elevated Pressures and Temperatures," Granet, Irving and Philip Kass, *Pet. Refiner*, Oct. 1952, pp. 113-114.
Graphical presentation.

"Physical Constants Useful in Petroleum Refining," *Pet. Refiner*, May 1950, pp. 116-117.
Boiling points; density; vapor pressure; specific volume; vapor density; critical constants; latent heats; heats of combustion, tabulated for paraffins, napthenes, olefins, aromatics, miscellaneous solvents and gases.

1957 Petrochemical Plant Directory

Here, for the benefit of the many thousands of our readers who may not have had an opportunity of seeing it in the September issue of *Petroleum Processing*, is an abridged version of that magazine's sixth annual survey of U.S. petrochemical plants. Our version omits *PP's* list of Canadian plants, and a glossary of chemicals now being produced from petroleum and natural gas sources.

IN RECENT years petroleum, natural gas and natural gas liquids have become increasingly important sources of chemicals, with nearly 200 U.S. companies now in the petrochemical picture.

During the six years that *Petroleum Processing's* editors have been making this survey, the increase has been three-fold, both in terms of the number of companies and the number of plants. Total investment in petrochemical plants now stands at about $4 billion in the U.S. alone, with about another $1 billion planned for expansion.

Both petroleum companies and chemical companies are prominently represented in the petrochemical business, with a fairly sizable sprinkling of new concerns formed specifically for the production of chemicals from petroleum sources. In several cases, chemical and petroleum concerns have gotten together to organize joint subsidiaries to exploit this important raw material source.

Many of the products shown in this directory are also available, of course, from non-petroleum sources. In making the compilation the aim has been to exclude plants using such products, or to indicate where both petroleum- and non-petroleum-based raw materials are used.

A

AIR REDUCTION CHEMICAL CO.
Calvert City, Ky.
Approximate original investment: $3,000,000
Products and output:
Vinyl acetate—30 million lb./yr.
★Methyl butanol—3 million lb./yr.
★Vinyl stearate—2 million lb./yr.
Personnel: O. W. Fortner, mgr.; J. W. Frevert, supt. and chf. engr.
Remarks: ★Building, completion late 1957. Subsid. of Air Reduction Co., Inc.

ALLIED CHEMICAL & DYE CORP.
(Barrett Division)
Frankford, Pa.
Hydrocarbon raw materials:
Propane-propylene blend
Products and output:
Phenol—30,000,000 lb./yr.
Acetone
Personnel: Thomas Lee, mgr.; J. C. Shea, supt.; J. T. Keating, chf. engr.

ALLIED CHEMICAL & DYE CORP.
(General Chemical Division)
El Segundo, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfuric acid—150,000 ton/yr.
Personnel: Geo. W. Miller, mgr.; W. B. Yarborough, chf. engr.
Remarks: Refinery gases are supplied by Standard Oil Co. of California.

ALLIED CHEMICAL & DYE CORP.
(General Chemical Division)
Richmond, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfuric acid—100,000 ton/yr.
Personnel: D. L. Hicken, mgr.; W. B. Yarborough, chf. engr.
Remarks: Refinery gases supplied by Standard Oil Co. of California.

ALLIED CHEMICAL & DYE CORP.
(National Aniline Division)
Buffalo, N. Y.
Hydrocarbon raw materials:
Kerosene fraction
White oil fraction
Products and output:
Alkyl aryl sulfonates (water soluble)
Alkyl aryl sulfonates (oil soluble)
Dodecylbenzene
Personnel: J. F. Daly, mgr.; B. R. MacKinnon, supt.; H. W. Busch, chf. engr.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division)
La Platte, Neb.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—75,000 ton/yr.
Urea—110,000 ton/yr.
Nitrogen solutions
Personnel: R. L. Riggs, mgr.; V. A. Perringer, supt.; I. H. Novikoff, chf. engr.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division)
South Point, Ohio
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—320,000 ton/yr.
Urea—80,000 ton/yr.
Methanol—53,500 ton/yr.
Formaldehyde—42,500 ton/yr. (100%)
Nitrogen solutions
High analysis mixed fertilizer
Urea-formaldehyde concentrate
Personnel: M. W. Butler, mgr.; G. E. Brandon, Jr., supt.; J. H. Critcher, chf. engr.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division)
Orange, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene oxide—12,000 ton/yr.
Ethylene glycol—16,000 ton/yr.
Ethanolamines
Diethylene glycol
Triethylene glycol
Personnel: E. L. Ray, mgr.; H. Lanier, supt.; J. E. Hollis, Jr., chf. engr.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division)
Hopewell, Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—400,000 ton/yr.
Ammonium nitrate
Nitrogen solutions
Sodium nitrate
Nitrogen tetroxide
Personnel: F. A. Ernst, mgr.; S. G. Mckenzie, supt.; W. L. E. Dewling, chf. engr.

ALLIED CHEMICAL & DYE CORP.
(Semet-Solvay Division)
Tonawanda, N. Y.
Hydrocarbon raw materials:
Ethylene (from fuel oil)
Fuel oil
Products and output:
Polyethylenes—20,000,000 lb./yr.
Butadiene—8,000,000 lb./yr.
Propylene—10,000,000 lb./yr.
High melting polyethylene wax
Polyethylene resin pipe compound
Personnel: A. J. Koehne, supt.; H. J. Andresen, chf. engr.
Remarks: Crude light oils are recovered and refined at another location. Present polyethlyene facilities represent a $10-million investment. Installing additional capacity for polyethylene resin pipe compound, to be available at the end of 1957.

ALLIED CHEMICAL & DYE CORP.
(Solvay Process Division)
Moundsville, W. Va.
Hydrocarbon raw materials:
Methane
Products and output:
Methyl chloride
Methylene chloride
Chloroform
Carbon tetrachloride
Hydrogen chloride
Total—11,500 ton/yr.
Personnel: R. B. Lautner, mgr.; C. D. Smith, supt.

ALOX CORP.
Niagara Falls, New York
Hydrocarbon raw materials:
Oxygenated petroleum hydrocarbons
Products and output:
Rust preventives, oil and cutting oil additives, total—12.5 million lb./yr.
Personnel: C. A. Weltman, mgr.; E. F. Tiegerman, supt.
Remarks: Parent, Montgary Explorations Ltd., Toronto, Ont.

AMERICAN CYANAMID CO.
Fortier, La.
Approximate investment: $50,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia
Ammonium sulfate
Acetylene
Hydrocyanic acid
Acrylonitrile
Sulfuric acid
Personnel: C. F. Bonnet, mgr.
Remarks: Company started $39,000,000 program to double acrylonitrile capacity in April, 1956. Completion expected late 1957.

AMERICAN OIL CO.
El Dorado, Ark.
Hydrocarbon raw materials:
Propane-propylene
Butane-butylene
Products and output:
Propylene tetramer—3.8 million gal./yr.
Polybutylene—2 million gal./yr.
Trimer—350,000 gal./yr.
Personnel: J. M. Brown, mgr.; C. L. Parris, chf. engr.
Remarks: Formerly Pan-Am Southern Corp. Parent, Standard Oil Co. (Ind.). Sales organization is Amoco Chemicals Corp.

AMERICAN OIL CO.
Destrehan, La.

Hydrocarbon raw materials:
Butenes
Products and output:
Polybutenes—250 b./d.
Personnel: H. A. Heiss, mgr.
Remarks: Formerly Pan-Am Southern Corp. Parent, Standard Oil Co. (Ind.) Amoco Chemicals Corp. is sales organization.

AMERICAN OIL CO.
Texas City, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Plasticizers
Polymers and resins
Benzene
Toluene
Xylene
Methyl mercaptan
Personnel: B. F. Babin, mgr.
Remarks: Parent, Standard Oil Co. (Ind.). Amoco Chemicals Corp. is sales organization.

AMERICAN OIL CO
Yorktown, Va.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur—50 ton/day
Personnel: M. C. Hopkins, mgr.
Remarks: Parent, Standard Oil Co. (Ind.). Sulfur unit construction by Fluor Corp., Ltd. Completion due Nov. 1957. Amoco Chemicals Corp. is sales organization.

AMERICAN SYNTHETIC RUBBER CORP.
Camp Ground Road, Louisville, Ky.
Approximate investment: $8,200,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
Synthetic rubber—68,500 long ton/yr.
Personnel: H. W. Cable, v.p.-mfg.; R. W. MacFarlane, prod. supt.; E. W. Zipfel, chf. engr.
Remarks: Recent addition of 24,500 long ton/yr. capacity cost $3,500,000; was completed May 1957.

AMOCO CHEMICALS CORP.
Joliet, Ill.
Approximate original investment: $10,000,000
Hydrocarbon raw materials:
Xylenes
Products and output:
Phthalic anhydride
Isophthalic acid
Terephthalic acid
Dimethyl terephthalate
Dimethyl isophthalate
Benzoic acid
Total chemicals—60 million lb./yr.
Personnel: C. L. Parris, mgr.
Remarks: $10 million, 60 million lb./yr. oxidation plant, using Scientific Design Co-developed process. Building, for completion 1958. Parent, Standard Oil Co. (Ind.).

AMOCO CHEMICALS CORP.
Brownsville, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Acetaldehyde
Propionaldehyde
Methanol
Ethanol
Isopropanol
N-propanol
Isobutanol
Acetone
Methyl propyl ketone
Methyl ethyl ketone
Methyl butyl ketone
Acetic acid
Propionic acid
Total chemicals—180 million lb./yr.
Personnel: L. L. Smith, mgr.; G. F. Moore, supt.; J. D. Wells, chf. engr.
Remarks: Formerly Hildago Chemical Corp. Plant undergoing rehabilitation. Parent, Standard Oil Co. (Ind.).

AMOCO CHEMICALS CORP.
Texas City, Texas
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Aromatic solvents
Methyl mercaptan
Nanene
Hydrocarbon plasticizers
Petroleum resins
Drying oils
Personnel: J. D. Reed, plt. mgr.; O. W. Collier, supt.; E. Schlesser, chf. engr.
Remarks: Parent, Standard Oil Co. (Ind.). Formerly part of American Oil Co.

APACHE POWDER CO.
Curtiss, Arizona
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—30 ton/day
Remarks: Girdler Co. designed, engineered and will start up $1 million, 30 ton/day ammonia plant, for completion end of 1957.

ATLANTIC REFINING CO.
Philadelphia, Pa.
Hydrocarbon raw materials:
Asphalt
Byproduct hydrogen from cat reformer
Petroleum fractions
Refinery gases
Solvent extracts
Products and output:
Alkylbenzene
Ammonia
Aromatic solvents
Butylenes
Crude carbolates
Crude cresylic acid
Crude mercaptans
Diisobutylene
Dodecylbenzenesulfonic acid type of water-soluble alkyl aryl sulfones
Nonyl dodecylbenzene
Propane
Sulfonated petroleum aromatic compounds
Sulfuric acid
Synthetic detergents
Technical eicosane
Thermoplastic resin
Various solvents, plasticizers, organic acids, etc.
Personnel: D. T. Shaw, mgr.
Remarks: Increasing ammonia capacity from 100 ton/day to 165 ton/day, part of $11 million expansion program. Status, engineering.

ATLANTIC REFINING CO.
Atreco, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic detergents
Personnel: P. L. Robison, mgr.

ATLAS PROCESSING CO.
Shreveport, La.
Approximate investment: $5,975,000
Hydrocarbon raw materials:
Naphtha from natural gas
Products and output:
Benzene—602 b./d.
Personnel: V. B. Chance, pres. & mgr.; C. S. Luce, supt.; W. L. Hiller, chf. engr.
Remarks: Plan UOP-designed Penex Isomerization unit. Construction to begin Sept. 1957, tentative completion date March 1958. Hudson Engineering Co., builder.

AURORA GASOLINE CO.
Detroit, Mich.
Approximate investment: $250,000
Hydrocarbon raw materials:
Refinery streams
Products and output:
Sulfur—9,900 ton/yr.
Personnel: P. Blasco, supt.; H. J. Oberding, chf. engr.

B & C

BAKELITE CO.
Marietta, Ohio
Hydrocarbon raw materials:
Phenol
Products and output:
Styrene
Remarks: Raw materials include both petroleum and non-petroleum sources. Parent, Union Carbide Corp.

BARIUM REDUCTION CORP.
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon disulfide
Sodium sulfhydrate
Personnel: L. Preisman, tech. dir. and genl. mgr.; C. F. Hobson, supt.; E. W. Wick, chf. engr.

THE BORDEN CO. (Chemical Division)
Fayetteville, N. C.
Hydrocarbon raw materials:
Methanol
Products and output:
Formaldehyde—36,000,000 lb./yr.
Personnel: C. Fulp, mgr.; I. Welborn, supt.
Remarks: In operation since 3-1-57.

THE BORDEN CO. (Chemical Division)
Kent, Wash.
Hydrocarbon raw materials:
Methanol
Products and output:
Formaldehyde—36 million lb./yr.
Personnel: R. T. Hanson, mgr.; B. Butler, chf. engr.
Remarks: In operation since Feb., 1957.

BRAY CHEMICAL CO.
Los Angeles, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lubricating oil additives
Petroleum sulfonates—15 million lb./yr.
Personnel: R. P. Schuster, mgr.; C. N. Whitaker, chf. engr.

CABOT CARBON CO.
Franklin, La.
Hydrocarbon raw materials:
Petroleum residues
Natural gas
Products and output:
Carbon blacks—157 million lb./yr.
Personnel: D. C. Paulsen, plt. mgr.; H. S. Ayres, plt. supt.

CABOT CARBON CO.
Ville Platte, La.
Hydrocarbon raw materials:
Petroleum residues
Natural gas
Products and output:
Furnace blacks—129 million lb./yr.
Personnel: R. D. Gibson, plt. mgr.; R. T. Bowen, plt. supt.

CABOT CARBON CO.
Big Spring, Texas
Hydrocarbon raw materials:
Petroleum residues
Products and output:
Oil furnace blacks—67.3 million lb./yr.
Personnel: A. R. Davenport, plt. supt.

CABOT CARBON CO.
Kermit, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks—28 million lb./yr.
Personnel: B. F. Bulls, plt. supt.

CABOT CARBON CO.
Pampa, Texas
Hydrocarbon raw materials:
Natural gas
Petroleum residues
Products and output:
Furnace blacks—51 million lb./yr.
Personnel: E. J. O'Brien, plt. supt.

CABOT CARBON CO.
Skellytown, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks for rubber, ink, and paint
Total—27 million lb./yr.
Personnel: W. L. Marshall, plt. mgr.; J. M. Brown, plt. supt.

CALCASIEU CHEMICAL CORP.
Lake Charles, La.
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene oxide
Ethylene glycol—8 million gal./yr.
Remarks: To be engineered and operated by Petroleum Chemicals, Inc. Lummus Co. will build the $11 million unit, using Shell Development Co.'s ethylene oxide process. Completion scheduled early 1958. Owners, Cities Service Co., Continental Oil Co., Sears, Roebuck & Co., and Minerals Industries, Inc.

CALIFORNIA SPRAY CHEMICALS CORP.
Richmond, Calif.
Hydrocarbon raw materials:
Petroleum bases
Natural and refinery gases
Products and output:
Aromatic solvents
Spray detergents
Emulsifiers
Summer & winter oil sprays
n-trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide
n-butyl,2,4-dichlorophenoxyacetate
Isopropyl,2,4-dichlorophenoxyacetate
2,4-dichlorophenoxy-acetic acid, dimethylamine salt
Tetrahydrofurfuryl,2,4,5-trichlorophenoxy-acetate

Tetraethyl pyrophosphate
Ethylene glycol mono-oleate
Ammonia—300 ton/day
Nitric acid—250 ton/day
Ammonium sulfate—200 ton/day
Ammonium nitrate—175 ton/day
Fertilizer solutions—950 ton/day
Personnel: E. W. Cannon, v.p.
Remarks: Parent, Standard Oil Co. of Calif.

CALUMET NITROGEN PRODUCTS CO.
Hammond, Ind.
Approximate original investment: $9,000,000
Hydrocarbon raw materials:
Reformer off-gas
Products and output:
Anhydrous ammonia—109,500 ton/yr.
Nitrogen solutions—36,500 ton/yr.
Remarks: Byproduct hydrogen to be obtained from Standard Oil (Ind.)., Whiting, Ind., and Sinclair, East Chicago, Ind., refineries. Indiana Std. to operate. New company is jointly owned (55% Indiana Std. & 45% Sinclair.) Plant scheduled for completion Aug. 1957.

CARBON BLACKS, INC.
Rayville, La.
Approximate investment: $100,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black—720,000 lb./yr.
Personnel: J. H. Mann, Jr., pres.; J. H. Mann, Sr., treas. & gen. mgr.

CARLISLE CHEMICAL WORKS, INC
Reading, Ohio
Hydrocarbon raw materials:
Petroleum fractions
Naphthenic acid
Products and output:
Lead napthenate
Lube additives (extreme pressure type)
Esters of petroleum derivatives
Personnel: K. L. Schanbacher, pres.; W. R. Hawkins, supt.; H. E. Klotz, chf. engr.
Remarks: Parent, Cincinnati Milling Machine Co.

CELANESE CORP. OF AMERICA
Bishop, Texas
Hydrocarbon raw materials:
Propane and butane
Products and output:
Methanol
n-propanol
Formaldehyde
Paraformaldehyde
Acetaldehyde
Acetic acid
Acetone
Butylene glycol
Propylene oxide and glycol
Dipropylene glycol
Trioxane
Iso- and n-butanol
Isobutyl, n-butyl, and n-propl acetate
Methylal
Ethylene glycol diacetate
Personnel: J. F. Frick, mgr.
Remarks: Building new trimethylolpropane plant for completion late 1957. Arthur Bros. Co., contractor.

CELANESE CORP. OF AMERICA
Pampa, Texas
Hydrocarbon raw materials:
Butane
Products and output:
Acetaldehyde
Acetic acid and anhydride
Vinyl acetate
Propionic and butyric acid
Methanol and solvents
Methyl ethyl ketone
Personnel: H. V. Wilks, mgr.
Remarks: Building 15 million lb./yr. acrylate ester plant for completion late 1957. Farnsworth and Chambers Construction Co., contractor.

CELANESE CORP. OF AMERICA
(Plastics Division)
Houston, Texas
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Low press. polyethylene, Fortiflex—40 million lb./yr.
Personnel: B. E. Cash, mgr.; S. T. Ross, supt.; W. G. Hamm, chf. engr.
Remarks: Operations started April 1957.

CELANESE CORP. OF AMERICA
Gallipolis Ferry, W. Va.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Tricresyl phosphate
Plasticizers
Functional fluids
Dialkyl phosphate
Phenyl dicresyl phosphate
Chlorinated phosphates
Pentaerythritol esters
Personnel: P. C. Pearson, mgr.
Remarks: Uses raw materials from Bishop and Pampa, Texas, plants, plus some coal-tar hydrocarbons.

CHEMOIL CORP.
New Orleans, La.
Hydrocarbon raw materials:
Crude oils
Products and output:
Benzene
Toluene
Xylenes
Ethylene
Propylene
Personnel: J. R. Tusson, pres.
Remarks: Completion of refinery due Dec. 1959.

CHEMSTRAND CORP.
Decatur, Ala.
Hydrocarbon raw materials:
Natural gas
Products and output:
Acrylic fiber, Acrilan
Personnel: Dr. K. Johnson, mgr.
Remarks: To increase Acrilan plant capacity to 45 million lb./yr. for 1958 completion. Parents, Monsanto Chemical Co. & American Viscose Corp.

CHEMSTRAND CORP.
Pensacola, Fla.
Hydrocarbon raw materials:
Natural gas
Cyclohexane
Products and output:
Nylon—88 million lb./yr.
Personnel: F. G. Gronemeyer, mgr.; R. T. Phelps, Jr., engrg. supt.; L. E. Dequine, Jr., asst. mgr.
Remarks: To increase nylon capacity to 114 million lb./yr. Completion scheduled for 1958.

COLLIER CARBON & CHEMICAL CORP.
Brea, Calif.
Approximate original investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—86,000 ton/yr.
Nitric acid (100% basis)—44,000 ton/yr.
Ammonium nitrate—55,000 ton/yr.
Ammonium phosphate—25,000 ton/yr.
Dry ice and carbon dioxide—34,000 ton/yr.
Personnel: R. S. Ogilvie, supt.; M. G. Dalich, oper. supt.; H. E. Kinsella, supt. maint. engrg.
Remarks: Formerly Brea Chemicals, Inc. Merged with R. T. Collier Corp. by parent, Union Oil Co. of Calif.

COLLIER CARBON & CHEMICAL CORP.
Fresno, Calif.
Approximate original investment: $100,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonium phosphate—17,000 ton/yr.
Remarks: Formerly Brea Chemicals, Inc. Merged with R. T. Collier Corp. by parent, Union Oil Co. of Calif.

COLUMBIA RIVER CHEMICALS, INC.
Attalia, Wash.
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Bunker C fuel oil
Products and output:
Anhydrous ammonia—57,600 ton/yr.
Ammonium sulfate—50,400 ton/yr.
Urea—39,600 ton/yr.
Remarks: Reported still in planning stage, though project is temporarily held in abeyance.

COLUMBIA-SOUTHERN CHEMICAL CORP.
Barberton, Ohio
Hydrocarbon raw materials:
Propylene
Acetylene
Products and output:
Perchloroethylene
Trichlorethylene
Personnel: W. S. Straub, mgr.; W. Harris, oper. supt.; J. A. Hanlon, chf. engr.
Remarks: Parent, Pittsburgh Plate Glass Co.

COLUMBIA-SOUTHERN CHEMICAL CORP.
Natrium, W. Va.
Hydrocarbon raw materials:
Hydrogen
Benzene
Products and output:
Anhydrous ammonia
Monochlorobenzene
Dichlorobenzene
Benzenehexachloride
Personnel: C. E. Wolf, mgr.; J. A. Clapperton, oper. supt.; G. L. Cobb, chf. engr.
Remarks: Parent, Pittsburgh Plate Glass Co.

COLUMBIAN CARBON CO.
El Dorado, Ark.
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black—63 million lb./yr.
Personnel: R. H. Cobb, supervisor.

COLUMBIAN CARBON CO.
Hickok, Kans.
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black—32.2 million lb./yr.
Personnel: J. W. Buchanan, supervisor.

COLUMBIAN CARBON CO.
Eola, La.
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black—45.5 million lb./yr.
Personnel: A. L. Wempe, supervisor.

COLUMBIAN CARBON CO.
Franklin, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Furnace Black—52.5 million lb./yr.
Personnel: J. S. Norris, Jr., supervisor.

COLUMBIAN CARBON CO.
Hancock, La.
Remarks: An experimental pilot plant, operating on natural gas to produce furnace blacks.

COLUMBIAN CARBON CO.
Eunice, N. Mex.
Hydrocarbon raw materials:
Natural and casinghead gas
Products and output:
Channel black—24.5 million lb./yr.
Personnel: C. E. Thompson, supervisor.

COLUMBIAN CARBON CO.
Coltexo, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel black—6.55 million lb./yr.
Personnel: Bernard Johnson, supervisor, main plant; Howard Johnson, supervisor plant 2.

COLUMBIAN CARBON CO.
Conroe, Texas
Hydrocarbon raw materials
Natural gas and/or petroleum fractions
Products and output:
Furnace black—68.6 million lb./yr.
Personnel: C. C. May, supervisor.

COLUMBIAN CARBON CO.
Corpus Christi, Texas
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black—11.3 million lb./yr.
Personnel: J. C. Aulds, supervisor

COLUMBIAN CARBON CO.
Fortune, Texas
Remarks: Furnace black plant, idle since March 25, 1955, on standby.

COLUMBIAN CARBON CO.
Kingsmill, Texas
Remarks: Channel black plant, idle since July, 1954, has been dismantled.

COLUMBIAN CARBON CO.
Lefors, Texas
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black—26 million lb./yr.
Personnel: R. M. Harvey, supervisor.

COLUMBIAN CARBON CO.
Seagraves, Texas
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black—53.9 million lb./yr.
Personnel: R. Fowler, supervisor.

COLUMBIAN CARBON CO.
Seminole, Texas
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black—27 million lb./yr.
Sulfur—15.4 million ton/yr.
Personnel: J. E. Earhart, supervisor.

COLUMBIAN CARBON CO.
Sweeney, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black—867,600 lb./yr.
Personnel: E. Johnson, supervisor.

COMMERCIAL SOLVENTS CORP.
Peoria, Ill.

Hydrocarbon raw materials:
Natural gas
Products and output:
Nitroparaffins
Personnel: T. M. Walton, mgr.

COMMERCIAL SOLVENTS CORP.
Sterlington, La.
Approximate investment: $45,000,000
Hydrocarbon raw materials:
Natural gas and propane
Products and output:
Ammonia—135,000 ton/yr.
Methanol
Ammonium nitrate solutions
Solid ammonium nitrate fertilizer
Nitroparaffins—10 million lb./yr.
Personnel: J. E. Wheeler, genl. mgr. prod., petrochemicals division.
Remarks: $10 million program to increase production of methanol and petrochemicals will be completed in 1957.

CONSOLIDATED CHEMICAL INDUSTRIES (Div., Stauffer Chemical Co.)
Baton Rouge, La.
Hydrocarbon raw materials:
Hydrogen sulfide
Alkylation sludge
Products and output:
Sulfuric acid
Sulfur
Personnel: W. J. Daspit, mgr.

CONSOLIDATED CHEMICAL INDUSTRIES (Div., Stauffer Chemical Co.)
Baytown, Texas
Hydrocarbon raw materials:
Hydrogen sulfide
Alkylation sludge
Products and output:
Sulfuric acid
Sulfur
Personnel: Z. L. Evans, mgr.
Remarks: Sulfur recovery capacity being increased 100 ton/day. Unit being built by Ralph M. Parsons Co., for completion early 1958.

CONSOLIDATED CHEMICAL INDUSTRIES (Div., Stauffer Chemical Co.)
Houston, Texas
Hydrocarbon raw materials:
Alkylation sludge
Products and output:
Sulfuric acid
Sulfur
Personnel: O. D. Massey, mgr.

CONTINENTAL BLACKS, INC.
Westlake, La.
Hydrocarbon raw materials:
Refractory refinery cycle stock
Products and output:
Carbon black—40 million lb./yr.
Personnel: W. Fergus, mgr.

CONTINENTAL BLACKS, INC.
Ponca City, Okla.
Hydrocarbon raw materials:
Refractory refinery cycle stock
Products and output:
Carbon black—60 million lb./yr.
Personnel: F. Forbes, mgr.

CONTINENTAL CARBON CO.
Eunice, New Mex.
Hydrocarbon raw materials:
Natural gas
Products and output:
SRF black—25 million lb./yr.
Channel black
Personnel: F. W. Keith, mgr.

CONTINENTAL CARBON CO.
Sunray, Texas
Hydrocarbon raw materials:
Dry natural gas
Refractory refinery cycle stock
Products and output:
Carbon blacks
Personnel: Norman Higgins, mgr.

CONTINENTAL OIL CO.
Chicago, Ill.
Hydrocarbon raw materials:
Dodecylbenzene
Products and output:
Water soluble sulfonates
Oil fracturing compounds
Personnel: T. J. Karolenko, supt.

CONTINENTAL OIL CO.
Lake Charles, La.
Approximate original investment: $2,700,000
Hydrocarbon raw materials:
Propylene
Products and output:
Benzene
Toluene
Xylene
Dodecene
Propylene tetramer
Pentadecene
Personnel: J. M. Jones, mgr.
Remarks: Dodecene and benzene are delivered to the Continental petrochemical plant at Baltimore, Md., where dodecylbenzene is produced for the detergent industry.

CONTINENTAL OIL CO.
Baltimore, Md.
Hydrocarbon raw materials:
Benzene
Dodecene
Products and output:
Synthetic detergent base stock
Personnel: W. O. Miller, supt.

CONTINENTAL OIL CO.
Billings, Mont.
Hydrocarbon raw materials:
Hydrogen sulfide
Products and output:
Sulfur
Personnel: J. A. Ramsey, supt.; J. L. Bruce, chf. engr.

CONTINENTAL OIL CO.
Ponca City, Okla.
Approximate investment: $7,500,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene and other aromatic mixtures (as reformate)—3,850 b./d.
Toluene
Propylene tetramer
Personnel: C. D. Hull, mgr.

CONTINENTAL OIL CO. (Bryton Chemical Div.)
Trainer, Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sodium sulfonates
Calcium sulfonates
Barium sulfonates
Ammonium sulfonates
Personnel: E. W. Carlson, mgr.; C. H. Blouch, supt.

CONTINENTAL OIL CO. (Sherwood Refining Div.)
Gretna, La.
Hydrocarbon raw materials:
Petroleum fractions
Lube oil stocks
Raw petrolatums
Products and output:
White oils
Natural sulfonates
Refined petrolatums
Personnel: K. R. Gerhart, supt.

COOPERATIVE FARM CHEMICALS ASSN.
Lawrence, Kans.
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—13,200 ton/yr.
Ammonium nitrate—83,000 ton/yr.
Nitrogen solutions—13,200 ton/yr.
Personnel: R. R. Zurbuchen, mgr.; C. C. Chaffee, supt.; A. D. Fornelli, chf. engr.

COPOLYMER RUBBER & CHEMICAL CORP.
Baton Rouge, La.
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Butylene
Styrene
Products and output:
Butadiene—35,000 short ton/yr.
GR-S synthetic rubber—68,800 long ton/yr.
Personnel: T. B. Crowell, v.p. & mgr.; C. M. McKay, supt.; H. C. Henry, chf. engr.
Remarks: GR-S rubber capacity increased from 49,000 to 68,800 ton/yr.; July 1957.

COSDEN PETROLEUM CORP.
Big Spring, Texas
Approximate investment: $9,000,000
Hydrocarbon raw materials:
Aromatic naphtha
Depentanized straight run gasoline
LPG fraction
Cycle stock
Mixed xylenes
Products and output:
Benzene—2.5 million gal./yr.
Toluene—7 million gal./yr.
Xylene—9 million gal./yr.
Polybutene—1 million gal./yr.
Styrene—20 million lb./yr.
Ethylbenzene—22 million lb./yr.
Personnel: D. M. Krausse, mgr.; G. Grimes, supt.; E. B. McCormick, chf. engr.
Remarks: 20 million lb./yr. polystyrene capacity under construction by Blaw-Knox, engineer-contractor, 40 million lb./yr. dodecylbenzene planned, licensed by UOP. New styrene recovery plant on stream Feb. 1957.

CROWN CENTRAL PETROLEUM CORP.
Houston (Pasadena), Texas
Hydrocarbon raw materials:
Refinery gas streams
Products and output:
Ethylene
Propylene
Personnel: K. W. Shimeall, v.p. Southwest Opers.; R. T. Colquette, v.p. mfg.; R. S. Myers, supt.; H. E. Fisher, chf. engr.
Remarks: Petrochemical products extracted by Shell Chemical—propanes, butanes.

D

DEERE & CO. (Grand River Chemical Division)
Pryor, Oklahoma
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—65,800 ton/yr.
Urea—90,000 ton/yr.
Personnel: W. W. Yeandle, genl. mgr.; J. T. Purnell, supt.; J. E. Dew, chf. engr.; R. B. Ady, tech. mgr.

DELHI TAYLOR OIL CORP.
Corpus Christi, Texas
Hydrocarbon raw materials:
Crude oil and distillate
Products and output:
Benzene—1,050 b./d.
Toluene—700 b./d.
Personnel: F. A. Reneau, supt.; H. F. Warnke, chf. engr.
Remarks: Udex unit on stream July 1, 1957. Design capacity 7,000 b./d.

DIAMOND ALKALI CO. (Chlorinated Products Division)
Newark, N. J.
Hydrocarbon raw materials:
Benzene
Products and output:
Hexachlorobenzene
Chlorol
Miticides
2, 4-D
2, 4, 5-T
DDT
Benzene sulfonyl chloride
Dichlorphenol
Trichlorphenol
Organic intermediates
Muriatic acid
Personnel: John Burton, mgr.

DIAMOND ALKALI CO. (Chlorinated Products Division)
Painesville, Ohio
Hydrocarbon raw materials:
Paraffin wax
Products and output:
Chlorinated paraffin, liquid and resinous
Carbon tetrachloride
Anhydrous hydrogen chloride
Personnel: R. C. Rahn, mgr.; C. H. Shie, chf. engr.; C. Ashman, maint. supt.

DIAMOND ALKALI CO. (Chlorinated Products Division)
Deer Park, Houston, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Vinyl chloride
Polyvinyl chloride
Ethylene dichloride
Perchlorethylene
Paraffin solvent
Anhydrous hydrogen chloride
Personnel: W. J. Butler, mgr.
Remarks: Plan 50 million lb./yr. vinyl chloride unit for early 1958, design & engineering by Scientific Design Co., Inc., and construction by Brown & Root, Inc. Also plan "multimillion-dollar" acetylene from natural gas unit, with construction to start probably early 1958.

DIAMOND ALKALI CO. (Chlorinated Products Division)
Greens Bayou, Houston, Texas
Hydrocarbon raw materials:
Benzene
Products and output:
Benzene hexachloride
DDT
Hexachlorobutadiene
Hexachloroethane
Muriatic acid

Personnel: R. J. Koll, mgr.; L. W. Hindes, supt.; R. Selmoneit, chf. engr.
Remarks: Increasing capacity of DDT plant.

DIAMOND ALKALI CO.
(Chlorinated Products Division)
Belle, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Methyl chloride
Methylene chloride
Chloroform
Muriatic acid
Personnel: Ralph Martz, mgr.

DOW CHEMICAL CO.
Pittsburg, Calif.
Hydrocarbon raw materials:
Natural gas
Styrene
Butadiene
Products and output:
Methylene chloride
Methyl chloride
Chloroform
Carbon tetrachloride
Perchloroethylene
Styrene-butadiene latex
Personnel: L. O. Simenson, prod. mgr.

DOW CHEMICAL CO.
Torrance, Calif.
Hydrocarbon raw materials:
Styrene from ethylene
Products and output:
Expanded polystyrene—Styrofoam
Polystyrene—Styron
Personnel: D. W. Ryan, mgr.

DOW CHEMICAL CO.
Allyn's Point, Conn.
Hydrocarbon raw materials:
Styrene from ethylene
Products and output:
Expanded polystyrene—Styrofoam
Polystyrene—Styron
Personnel: K. E. Stober, mgr.

DOW CHEMICAL CO.
Baton Rouge—Plaquemine area, La.
Hydrocarbon raw materials:
Liquid petroleum gas
Products and output:
Ethylene
Propylene
Glycols
Vinyl chloride
Other chlorinated hydrocarbons and related products
Personnel: J. R. Stein, mgr.
Remarks: Completion of $50 million plant scheduled in 1958.

DOW CHEMICAL CO.
Midland, Mich.
Hydrocarbon raw materials:
Crude oil
Fuel oil
Ethylene
Propylene
Benzene
Styrene from ethylene
Products and output:
Styrene
Butadiene
Alpha methyl styrene
Ethylbenzene
Ethyl chloride
Ethylene dibromide
Polystyrene—Styrofoam
Polystyrene—Styron
Diethyl benzene
Divinyl benzene
Ethylene dichloride
Ethylene oxide
Mono-, di-, and tri-ethanolamine
Ethylene diamine
Isopropyl benzene
Isopropyl chloride
Propylene glycol
Propylene oxide
Propylene dichloride
Isopropanolamines
Polyglycols
Polyglycol ethers
Polyvinylidene chloride
Ethyl cellulose
Methyl cellulose
Polyvinyl chloride
Vinyl toluene
Personnel: W. H. Schuette, genl. mgr.

DOW CHEMICAL CO. (Riverside Plt.)
Pevely, Mo.
Hydrocarbon raw materials:
Styrene from ethylene
Products and output:
Polystyrene—Styron and Styrofoam
Personnel: R. E. Reinker, mgr.

DOW CHEMICAL CO. (Hanging Rock Plt.)
Ironton, Ohio
Hydrocarbon raw materials:
Styrene from ethylene
Products and output:
Polystyrene
Personnel: M. H. Weymouth, mgr.

DOW CHEMICAL CO. (Texas Division)
Freeport and Velasco, Texas
Hydrocarbon raw materials:
LPG
Natural gas
Butadiene
Methane (natural gas)
Ethylene and propylene
Benzene
Products and output:
Styrene
Methyl chloride
Ethyl chloride
Ethylene dichloride
Vinyl chloride
Carbon tetrachloride
Chloroform
Ethylene glycol
Diethylene glycol
Triethylene glycol
Tetraethylene glycol
Propylene glycol
Dipropylene glycol
Perchloroethylene
Trichloroethylene
Dichlorethyl ether
Dichlorisopropyl ether
Ethylene oxide
Propylene oxide
Latex
Methyl chloroform
Methylene chloride
Polyglycols
Propylene dichloride
Styrene oxide
Toluene
Vinylidene chloride
Butadiene
Glycerine
Polyethylene
Methylacetylene
Epichlorhydrin
Ethylene diamine
Diethylenetriamine
Personnel: A. P. Beutel, genl. mgr.
Remarks: Second glycerine plant under construction to double present capacity by March 1958. Additional ethylene glycol, chlorine, acetylene, ethanolamines and styrene facilities also under construction.

E. I. DU PONT DE NEMOURS & CO.
Antioch, Calif.
Products and output:
Tetraethyl lead
Ethyl chloride
Freon 11—Trichloromonofluoromethane
Freon 12—Dichlorodifluoromethane refrigerants
Remarks: Completion scheduled for early 1957. Sodium and chlorinated solvents plans at Antioch cancelled.

E. I. DU PONT DE NEMOURS & CO.
Circleville, Ohio
Products and output:
Polyester film, Mylar
Personnel: E. F. Ridlon, mgr.
Remarks: Plant expansion now in progress to increase capacity by 50%. New facilities to be ready for operation by spring of 1958.

E. I. DU PONT DE NEMOURS & CO.
Memphis, Tenn.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen cyanide
Sodium cyanide
Personnel: T. D. Bell, mgr.

E. I. DU PONT DE NEMOURS & CO.
Beaumont, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Methyl mercaptan
Products and output:
Methionine
Chlorosulfonated polyethylene
Personnel: H. C. Bailey, mgr.
Remarks: New chlorosulfonated polyethylene unit completed June, 1957.

E. I. DU PONT DE NEMOURS & CO.
La Porte, Texas
Hydrocarbon raw materials:
Methanol
Products and output:
Methylamines
Dimethyl formamide
Carbamate fungicides
Personnel: I. I. Chase, mgr.

E. I. DU PONT DE NEMOURS & CO.
Orange, Texas
Hydrocarbon raw materials:
Natural gas
Propane
Ethylene
Benzene
Cyclohexane
Products and output:
Nylon intermediates (adipic acid, hexamethylene diamine)
Methanol
Polyethylene, 100 million lb./yr.
Personnel: D. B. Campbell, mgr.
Remarks: Increasing capacity of polyethylene & modernizing adipic acid facilities.

E. I. DU PONT DE NEMOURS & CO.
Victoria, Texas
Hydrocarbon raw materials:
Natural gas
Butadiene
Products and output:
Adiponitrile
Personnel: M. T. Shattuck, mgr.
Remarks: Increasing capacity of adiponitrile.

E. I. DU PONT DE NEMOURS & CO.
Waynesboro, Va.
Products and output:
Acrylic staple, Orlon—40 million lb./yr.
Remarks: Building. Startup for early 1958.

E. I. DU PONT DE NEMOURS & CO.
Belle, W. Va.
Products and output:
Adipic acid
Hexamethylene diamine
Remarks: Replacing coal with natural gas as raw material for 650 ton/day ammonia plant and nylon intermediates. Overall conversion to be completed 1959.

D-X SUNRAY OIL CO.
Duncan, Okla.
Approximate investment: $500,000
Hydrocarbon raw materials:
Petroleum fractions
Propylene
Products and output:
Propylene tetramer—160,000 b./yr.
Personnel: R. L. Johnson, mgr.; R. C. Underwood, supt.; R. J. Riggs, chf. engr.
Remarks: Parent, Sunray Mid-Continent Oil Co.

E

EASTERN STATES CHEMICAL CORP.
Houston, Texas
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Petroleum naphthas
Products and output:
Benzene 2°—75,000 b./yr.
Propane—255,000 b./yr.
n-Butane—325,000 b./yr.
Isobutane
Isopentane—220,000 b./yr.
Personnel: H. M. Martin, mgr.; J. J. Carrigan, supt.; W. J. McBride, chf. engr.
Remarks: Parent, Eastern States Petroleum Co., Inc.

THOMAS A. EDISON INDUSTRIES
(Div., McGraw-Edison Co.)
Bloomfield, N. J.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen
Remarks: Hydrogen is produced by a Girdler "Hygirtol" catalytic steam-reforming unit. Hydrogen is not sold but used as a raw material in iron purification.

EL PASO NATURAL GAS CO.
Farmington, N. Mex.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—12,600 ton/yr.
Remarks: Company took over former plant of Imperial Sulfur & Acid Co. Sulfur operations shut down temporarily.

ESCAMBIA CHEMICAL CORP.
Pensacola, Fla.
Approximate investment: $30,000,000
Hydrocarbon raw materials:
Natural gas
Vinyl chloride monomer
Products and output:
Anhydrous ammonia—72,000 ton/yr.
Ammonium nitrate solutions, Bay-Sol—110,000 ton/yr.
Ammonium nitrate prills, Ammo-Nite—110,000 ton/yr.
Nitric acid—80,000 ton/yr.
Polyvinyl chloride resins—30 million lb./yr.
Personnel: R. U. Haslanger, pres.; A. E. New, prod. tech. dir.; R. M. Brown, plt. mgr.; D. J. Stark, v.p. and prod. mgr.

Remarks: 20 million gal./yr. methanol plant planned, for 1958 completion. Engineer-contractor, Chemical Construction and Badger.

ESSO STANDARD OIL CO.
Baton Rouge, La.
Hydrocarbon raw materials:
Natural gas
Petroleum gas and liquid fractions
Products and output:
Acetone
Ethyl alcohol
Isopropyl alcohol
Iso-octyl alcohol
Decyl alcohol
Tridecyl alcohol
Ethyl ether
Isopropyl ether
Isobutylene
Tetrapropylene
Tripropylene
Butadiene
Isoprene
Dicyclopentadiene
Benzene
Petroleum resins
Aromatic tars
Butyl rubber—47,000 long ton/yr.
Propane
Propylene
Personnel: H. J. Voorhies, genl. mgr.
Remarks: New ethylene unit is under construction.

ESSO STANDARD OIL CO.
Bayonne, N. J.
Products and output:
Naphthenic acid
Lube oil additives
Personnel: D. F. Edwards, mgr.

ESSO STANDARD OIL CO.
Linden, N. J.
Hydrocarbon raw materials:
Petroleum gases and liquid fractions
Products and output:
Isopropyl alcohol
Secondary butyl alcohol
Acetone
Ethylene
Methyl ethyl ketone
Isopropyl acetate
Isopropyl ether
Secondary butyl acetate
Isobutylene
Polyisobutylene
Lube oil additives
Naphthenic acids
Personnel: G. R. Murrell, mgr.
Remarks: A new ethylene unit is scheduled for completion in 1957.

ETHYL CORP.
Baton Rouge, La.
Hydrocarbon raw materials:
Ethane
Ethylene
Products and output:
Ethyl chloride
Ethylene dichloride
Tetraethyl lead
Personnel: W. F. Armstrong, resident mgr.; J. J. Bergin, asst. resident mgr.; A. C. Burdick, chf. engr.
Remarks: Plan vinyl chloride-from-ethylene plant, by Catalytic Construction Co., for late 1957.

ETHYL CORP.
Houston, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethyl chloride
Ethylene dichloride
Anti-knock compound
Personnel: M. C. Hudgins, mgr.; L. L. Davis, oper. supt.; R. E. Hodgkinson, chf. engr.

ETHYL-DOW CHEMICAL CO.
Freeport, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene dibromide
Personnel: V. A. Thorpe, plt. mgr.
Remarks: Increasing ethylene dibromide capacity 20% for fall 1957.

F

FIRESTONE PLASTICS CO.
Pottstown, Pa.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Polybutadiene-acrylonitrile type acyclic elastomers
Polybutadiene-styrene type acyclic elastomers
Personnel: W. D. Handley, mgr.

FIRESTONE TIRE & RUBBER CO.
(Synthetic Rubber and Latex Div.)
Lake Charles, La.
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber (butadiene-styrene type)—190,000 long ton/yr.
Personnel: W. H. Cain, mgr.; C. V. Dille, supt.; C. R. McBride, chf. engr.

FIRESTONE TIRE & RUBBER CO.
(Synthetic Rubber and Latex Div.)
Akron, Ohio
Approximate investment: $2,350,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber—40,000 long ton/yr.
Synthetic latex (butadiene-styrene type)
Personnel: R. J. Easton, supt.; C. J. Weber, chf. engr.

FIRESTONE TIRE & RUBBER CO.
(Synthetic Rubber and Latex Div.)
Orange, Texas
Hydrocarbon raw materials:
Butane
Products and output:
Butadiene—40,000 short ton/yr.
Personnel: W. A. Wilson, mgr.; C. C. Ferguson, supt.; E. A. Lastrapes, chf. engr.
Remarks: In operation since June, 1957. Styrene plans at Orange cancelled.

FOOD MACHINERY AND CHEMICAL CORP.
FMC Organic Chemicals Division
Ohio-Apex, Nitro, W. Va.
Hydrocarbon raw materials:
Cresylic acid
Products and output:
Tricresyl phosphate
Diisooctyl phthalate plasticizer
Diallyl phthalate prepolymer plasticizer
Personnel: B. S. Taylor, mgr.; B. E. Gewin, supt.; A. H. Adler, chf. engr.

FOSTER GRANT CO.
Baton Rouge, La.
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Ethylene
Benzene
Products and output:
Styrene monomer—60 million lb./yr.
Personnel: F. D. Mayfield, mgr.
Remarks: Expansion program underway. Plant gets raw materials from Esso Standard Oil Co.'s Baton Rouge, La., refinery.

FREEPORT SULPHUR CO.
Westville, N. J.
Approximate investment: $550,000
Hydrocarbon raw materials:
Refinery gas
Products and output:
Sulphur—12,775 long ton/yr.
Personnel: J. K. Laberteaux, supt.

FRONTIER OIL REFINING CO.
Div., Ashland Oil & Refining Co.
Tonawanda, N. Y.
Approximate investment: $3,250,000
Hydrocarbon raw materials:
Cat reformate
Products and output:
Benzene—4.5 million gal./yr.
Toluene, Xylenes, Others—12 million gal./yr.
Personnel: R. E. Yancey, mgr. (Ashland); M. C. Sumpter, supt. (Frontier); G. S. Litton, chf. engr. (Ashland)
Remarks: Startup scheduled for early '58.

G

GENERAL ANILINE & FILM CORP.
Linden, N. J.
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene oxide—60 million lb./yr.
Ethylene glycol—35 million lb./yr.
Remarks: Scientific Design Co., Inc. has design and engrg. contract. Esso Std. Oil Co. will supply ethylene. Completion late 1957.

GENERAL PETROLEUM CORP.
Torrance, Calif.
Hydrocarbon raw materials:
Refinery wastes
Products and output:
Ammonium sulfate—10 ton/day
Personnel: A. E. Thompson, mgr.
Remarks: Ammonium sulfate made in small volume as a byproduct of anti-air pollution facilities. Parent, Socony Mobil Oil Co., Inc.

GENERAL TIRE & RUBBER CO.
Ashtabula, Ohio
Approximate investment: $7,500,000
Hydrocarbon raw materials:
Vinyl chloride
Products and output:
Polyvinyl chloride—36,000,000 lb./yr.
Personnel: P. J. Wallace, mgr.
Remarks: 50% expansion of polyvinyl chloride, started late 1956, now in operation.

GENERAL TIRE & RUBBER CO.
Mogadore, Ohio
Hydrocarbon raw materials:
Styrene
Butadiene
Products and output:
Polyesters
Styrene resins
Vinylpyridine type acyclic elastomers
Rubber-base-paint latex
Personnel: J. A. Kleinhans, mgr.; W. C. Martin, prod. supt.; R. W. Laundrie, tech. supt.
Remarks: Expansion underway in styrene resin facilities.

GENERAL TIRE & RUBBER CO.
Odessa, Texas
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S-type synthetic rubber—45,000 ton/yr.
Personnel: J. A. Pollock, mgr.; J. L. Bailey, supt.
Remarks: Completion expected Oct. 1, 1957. Cost to be $10 million for GR-S facilities only. Contractor, H. K. Ferguson Co.

GEORGIA-CAROLINA OIL CO.
Macon, Georgia
Personnel: R. W. Jones, pres.; R. W. Gober, mgr.; H. E. Chapman, supt.
Remarks: Chemical plant affiliate: Triangle Chemical Co., Macon, Georgia, manufacturers of agricultural chemicals, wood preservers.

B. F. GOODRICH CHEMICAL CO.
Louisville, Ky.
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Products and output:
Nitrile type synthetic rubber
Personnel: J. L. Nelson, mgr.

B. F. GOODRICH CHEMICAL CO.
Akron, Ohio
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Products and output:
Nitrile type synthetic rubber
Personnel: C. B. Cooper, mgr.

GOODRICH-GULF CHEMICALS, INC.
Avon Lake, Ohio
Approximate investment: $1,000,000
Products and output:
Synthetic rubber
Remarks: Pilot plant only. In operation since Nov. 1956. Parents, B. F. Goodrich Co. & Gulf Oil Corp.

GOODRICH-GULF CHEMICALS, INC.
Port Neches, Texas
Approximate investment: $13,000,000
Hydrocarbon raw materials:
Butadiene and styrene
Products and output:
"Ameripol" rubber (S-type)—100,000 ton/yr.
Personnel: W. R. Bateman, plt. mgr.; E. E. Mitchell, prod. mgr.; F. V. Morrison, plt. engr.; B. C. Pryor, tech. mgr.
Remarks: Parents, B. F. Goodrich Co. & Gulf Oil Corp.

GOODRICH-GULF CHEMICALS, INC.
Institute, W. Va.
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
Synthetic rubber
Personnel: F. C. Hands, mgr.; E. F. Barker, chf. engr.; John Haas, prod. mgr.
Remarks: The three production lines purchased from the government had rated capacity of

122,000 long ton/yr. One line, about ⅓ capacity, now operating. $2 million conversion of second line, planned to make Ameripol cold rubber, for early 1958 completion, will increase capacity slightly. Engr.-contr., The Girdler Corp. Parent companies are B. F. Goodrich Co. and Gulf Oil Corp.

GOODYEAR SYNTHETIC RUBBER CORP.
Akron, Ohio
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber—42,200 ton/yr.
Personnel: R. C. Stell, mgr.
Remarks: Increased capacity of copolymer by 27,000 ton/yr. Cost was $2.5 million; engineering by staff; contractor was Carmichael; completion was June, 1957. Parent, Goodyear Tire & Rubber Co.

GOODYEAR SYNTHETIC RUBBER CORP.
Houston, Texas
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S rubber—137,500 ton/yr.
Personnel: B. A. Rosinski, genl. mgr.; J. C. Blackwell, tech. supt.
Remarks: Increased capacity of copolymer by 70,000 ton/yr. Cost $10 million; engineering by Blaw-Knox; contractor is Tellepsen; completion was March 1957. A later project will bring capacity to 220,000 ton/yr. Parent, Goodyear Tire & Rubber Co.

GOODYEAR TIRE & RUBBER CO.
(Chemical Division)
Akron, Ohio
Approximate investment: $5,250,000
Hydrocarbon raw materials:
Butadiene
Acrylonitrile
Styrene
Products and output:
Butadiene-acrylonitrile rubbers
High styrene resins
Personnel: F. R. Thies, genl. mgr.; J. C. Blackwell, tech. supt.

GOODYEAR TIRE & RUBBER CO.
Niagara Falls, N. Y.
Hydrocarbon raw materials:
Acetylene
Products and output:
Polyvinyl chloride resins
Vinyl chloride copolymer dispersion resin
Vinyl chloride copolymer latex
Personnel: E. H. Manchester, mgr.; R. H. Evans, chf. engr.
Remarks: Was Pathfinder Chemical Co. Taken into parent, Goodyear Tire & Rubber Co., on Jan. 1, 1957.

W. R. GRACE & CO.
Baton Rouge, La.
Approximate investment: $18,000,000
Products and output:
Polyethylene—50 million lb./yr.
Remarks: Fluor Corp. has construction contract for Phillips-licensed process. Completion scheduled third quarter 1957.

W. R. GRACE & CO.
Acton, Mass.
Hydrocarbon raw materials:
Butadiene and styrene
Products and output:
Copolymers—4 million lb./yr.

GRACE CHEMICAL CO.
(Div. W. R. Grace & Co.)
Woodstock, Tenn.
Approximate investment: $20,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—100,000 ton/yr.
Urea—150 ton/day
Personnel: J. G. Carriere, mgr.

GREAT NORTHERN OIL CO.
Pine Bend, Minn.
Products and output:
Sulfur
Personnel: A. S. Gilliam, mgr.; C. W. Gilmore, chf. proc. engr.

GREAT SOUTHERN CHEMICAL CORP.
Corpus Christi, Texas
Hydrocarbon raw materials:
Distillate gasoline
Products and output:
Benzene—7.25 million gal./yr.
Toluene—13 million gal./yr.
Xylenes—4.2 million gal./yr.
Personnel: L. K. Grove, supt.

GULF OIL CORP.
Philadelphia, Pa.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Propylene
Sulfur—50,000 ton/yr.
Personnel: J. O. Timms, genl. mgr.

GULF OIL CORP.
Crane County, Texas (Waddell Plant)
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—7,000 ton/yr.
Personnel: John Sherman, mgr.

GULF OIL CORPORATION
Port Arthur, Texas
Hydrocarbon raw materials:
Refinery gases
Heptane
Propylene
Sulfuric acid sludge
Products and output:
Ethylene—400 million lb./yr.
Sulfur—120 ton/day.
Isocetyl alcohol—9 million lb./yr.
Propylene
Propylene polymers
Petroleum coke (sludge acid coke)
Butylenes
Aromatic distillates (ethylene coproduct)
Personnel: R. F. Faulkner, genl. mgr.
Remarks: Sulfur capacity was increased during 1957 and 4 new sludge decomposing units put into operation. 30 million benzene-toluene plant planned, with construction to start in 1957, completion for 1958.

H

HANCOCK CHEMICAL CO.
Wilmington, Calif.
Approximate investment: $3,500,000
Hydrocarbon raw materials:
Refinery hydrogen sulfide
Products and output:
Sulfur—200 ton/day
Personnel: G. E. Smalley, mgr.
Remarks: Raw gas comes from General Petroleum, Richfield, and The Texas Co. Two 65 ton/day sulfur recovery plants went on stream Sept., 1956.

HANCOCK OIL CO.
Long Beach, Calif.
Approximate investment: $350,000
Hydrocarbon raw materials:
Hydrogen sulfide from refinery gas
Products and output:
Sulfur—10 ton/day
Personnel: W. T. Hancock, mgr.
Remarks: Operates on hydrogen sulfide from Hancock's own refinery.

HAWTHORNE CHEMICAL CO.
Louisiana, Mo.
Approximate investment: $11,000,000
Hydrocarbon raw materials:
Methanol
Ammonia
Natural gas
Products and output:
Methylmethacrylate (monomers & polymers)—35 million lb./yr.
Remarks: Parent companies, Hercules Powder Co. & Imperial Chemical Industries, Ltd. $11 million project will use methanol and ammonia from Hercules Louisiana, Mo., plant, and natural gas piped from Texas.

HERCULES POWDER CO.
Hercules, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—50,000 ton/yr.
Personnel: E. St. P. Bellinger, mgr.

HERCULES POWDER CO.
Louisiana, Mo.
Approximate investment: $5,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—40,000 ton/yr.
Pentaerythritol—24,000,000 lb./yr.
Formaldehyde—100,000,000 lb./yr.
Methanol—7,000,000 gal./yr.
Methyl methacrylate
Personnel: J. B. Talley, mgr.
Remarks: New formaldehyde and pentaerythritol units, at cost of $6 million, now in production. $2 million methanol unit under construction as part of pentaerythritol production.

HERCULES POWDER CO.
Burlington, N. J.
Approximate investment: $4,500,000
Hydrocarbon raw materials:
Paraxylene
Products and output:
Dimethyl terephthalate—12,000,000 lb./yr.
Personnel: D. A. Bunce, mgr.

HERCULES POWDER CO.
Gibbstown, N. J.
Hydrocarbon raw materials:
Benzene and propylene
Cumene
Products and output:
Cumene
Cumene hydroperoxide
Phenol—26,000,000 lb./yr.
Acetone—16,000,000 lb./yr.
Paracresol—3,000,000 lb./yr.
Cymene alcohol
Methylstyrene
a-Methylstyrene
Acetophenone
Personnel: L. W. Rothenberger, mgr.
Remarks: Company has pilot scale manufacture of dicumyl peroxide.

HERCULES POWDER CO.
Parlin, N. J.
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Polyethylene—30,000,000 lb./yr.
Personnel: E. F. Jennings, Jr., mgr.
Remarks: Uses Ziegler process license. In operation July, 1957.

HERESITE CHEMICAL CO.
Manitowoc, Wis.
Hydrocarbon raw materials:
Butadiene and styrene
Products and output:
Polybutadiene-acrylonitrile type acyclic elastomers
Personnel: J. L. Place, mgr.

HEYDEN CHEMICAL CORP.
Now part of Heyden Newport Chemical Corp.

HEYDEN NEWPORT CHEMICAL CORP.
Fords, N. J.
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Methanol (from natural gas)
Products and output:
Pentaerythritol—25 million lb./yr.
Remarks: Under construction. Completion scheduled for July, 1957. Formerly Heyden Chemical Corp. plant.

HIDALGO CHEMICAL CO.
Brownsville, Tex.
Merged into Amoco Chemicals Corp. by parent, Standard Oil Co. (Ind.).

HOOKER ELECTROCHEMICAL CO.
Niagara Falls, N. Y.
Hydrocarbon raw materials:
Benzene
Toluene
Xylene
Pentane
Wax
Products and output:
Chlorobenzenes
Chlorotoluenes and their derivatives
Chlorinated waxes
Hexachlorocyclopentadiene
Personnel: R. F. Schultz, wks. mgr.; D. E. Springer, chf. engr.; M. L. Parker, prod. supt.
Remarks: Durez Plastics and Chemicals, Inc. was consolidated into Hooker in April, 1955, and Niagara Alkali was consolidated into Hooker in Nov., 1955. Oldbury Electro-Chemical Co. was consolidated into Hooker in Nov., 1956.

J. M. HUBER CORP.
Borger, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks—74 ton/day
Furnace blacks—90 ton/day
Personnel: H. S. Barbour, genl. mgr.; J. L. Speir, channel plt. supt.; L. V. Maxom, furnace plt. supt.; J. D. McGregor, chf. engr.
Remarks: A 20-30 million lb./yr. furnace black plant being planned to add 15% to company's furnace black capacity, completion date not set.

J. M. HUBER CORP.
Eldon, Texas
Hydrocarbon raw materials:
Oil
Products and output:
Carbon black—110 ton/day
Personnel: M. D. Nuttall, mgr.; J. B. Stewart, supt.; Paul Post, chf. engr.

HUMBLE OIL & REFINING CO.
Baytown, Texas
Approximate investment: $47,982,600
Hydrocarbon raw materials:
Refinery gases
Petroleum fractions

Products and output:
Toluene
Solvent xylene
Paraxylene
Aromatic quench oil
High boiling range aromatic solvents
Narrow boiling range aliphatic naphthas (hexane, heptane, octane)
Special naphthas
Cyclohexane
Tetrapropylene
Tripropylene
Normal butylene
Isobutylene
Propylene concentrate
Carbon black oil feed stock
Butadiene—65,000 ton/yr.
Butyl rubber—44,500 long ton/yr.
Personnel: G. L. Farned, plt. mgr.; J. Harrop, genl. supt.; E. F. Voss, chf. engr.
Remarks: 30 million gal./yr. benzene unit by Badger, for late '57; 80 million lb./yr. ethylene unit, by Kellogg, for fall of '58; 13,000 lb./yr. butyl rubber expansion, by Humble, for early '58.

I & J

INDEX CHEMICALS CO.
Houston, Texas
Hydrocarbon raw materials:
Butane and sulfur
Products and output:
Thiophene
Methyl, ethyl and octyl mercaptans
Dimethyl and diethyl sulfides
Remarks: Industrial Division, Pennsalt Chemicals Corp. has licensing agreement with Socony Mobil Oil Co. to manufacture and sell thiophene under Socony patents. Plant at Houston is operated by Index Chemical Co., a subsidiary of Pennsalt.

JEFFERSON CHEMICAL CO.
Port Neches, Texas
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene glycol
Diethylene glycol
Triethylene glycol
Polyethylene glycols
Ethylene carbonate
Propylene carbonate
Piperazine
Ethylene oxide
Ethylene dichloride
Mono-, di-, tri-ethanolamines
Monyl phenol
Aromatic distillate
Morpholine
Personnel: L. R. Strawn, genl. mgr.-mfg.; B. A. Davis, prod. supt.; M. H. Holmes, plt. mgr.; R. H. Darling, chf. engr.
Remarks: Parents, American Cyanamid Co. and The Texas Co. Plan $38 million expansion of chlorine, caustic soda, ethylene, ethylene oxide and ethylene glycol facilities.

JEFFERSON LAKE SULPHUR CO.
Manderson, Wyo.
Approximate investment: $700,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—50,000 long ton/yr.
Personnel: C. H. Lewis, genl. mgr.; James Leeper, supt.
Remarks: Operating at about 50% of capacity because of shortage of acid gas supplies.

K

M. W. KELLOGG CO.
Houston, Texas
Remarks: Company has purchased land on the Houston Ship Channel but has made no definite commitment on use. Kellogg holds a Phillips polyethylene process license, but has announced that will not build the polyethylene plant.

KENDALL REFINING CO.
Bradford, Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Heavy hydrocarbons
Petroleum polymer and condensation resins
Personnel: H. V. Smith, mgr.; S. M. Wolbert, chf. engr.

KOPPERS CO., INC.
Wilmington, Calif.
Remarks: Plans to build polyethylene plant jointly with Brea Chemicals Co., have been cancelled.

KOPPERS CO., INC.
Woodbridge, N. J.
Hydrocarbon raw materials:
Ethylene
Products and output:
Polyethylene—30 million lb./yr.
Personnel: E. H. Tenthoff, mgr.
Remarks: New plant under construction, completion Sept. '57. Koppers, engr.-contr. Ethylene to come from Esso's new unit being built at Linden.

KOPPERS CO., INC.
Monaca, Pa. (Kobuta Plant)
Approximate investment: $25,000,000
Hydrocarbon raw materials:
Benzene and ethylene
Products and output:
Styrene—90,000 ton/yr.
Polystyrene—25,000 ton/yr.
Divinyl benzene
Personnel: W. K. Todd, mgr.; H. Johnson, chf. engr.; M. R. Dawson & L. Wilkins, asst. mgrs.

KOPPERS CO., INC. (Chemical Div.)
Oil City, Pa.
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alkylated cresols—5 million lb./yr.
Personnel: C. L. Mehring, mgr.

KOPPERS CO., INC. (Chemical Div.)
Port Arthur, Tex. (Williams Plant)
Approximate investment: $19,000,000
Hydrocarbon raw materials:
Ethylene
Benzene
Products and output:
Ethylbenzene—120 million lb./yr.
Polyethylene—18 million lb./yr.
Personnel: H. E. Roche, genl. mgr.; D. B. Stewart, asst. mgr.

L & M

LEONARD REFINERIES, INC. (Leonard Refinery Div.)
Alma, Mich.
Products and output:
Sulfur
Cresylic acid
Personnel: R. W. Pollard, mgr.; C. E. Weaver, oper. supt.

LEONARD REFINERIES, INC. (Roosevelt Refinery Div.)
Mt. Pleasant, Mich.
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene and toluene—5.5 million gal./yr.
T-x concentrate—500,000 gal./yr.
Mineral seal oil—1 million gal./yr.
Aliphatic naphthas and solvents—18 million gal./yr.
Personnel: T. J. Williams, mgr.; B. Weber, asst. supt.

LUBRIZOL CORP.
Cleveland, Ohio
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Chemical additives for lubes
Personnel: C. G. O'Bannon, prod. mgr.

LUBRIZOL CORP.
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: K. A. Danskin, mgr.

LYNN CARBON BLACK CO.
San Angelo, Texas
Approximate investment: $175,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black—12 million lb./yr.
Personnel: W. H. Balka, engr. consultant

MAGNOLIA PETROLEUM CO.
Beaumont, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Cresylic acid
Personnel: R. G. Sanders, v.p. in charge; P. L. Smith, mgr.; C. M. Fabian, supt.; G. C. Defrey, chf. engr.
Remarks: Parent, Socony Mobil Oil Co., Inc.

MARBON CHEMICAL DIV.—BORG-WARNER CORP.
Gary, Indiana
Hydrocarbon raw materials:
Acrylonitrile
Butadiene
Styrene
Products and output:
High styrene resins for rubber and paint
Rubber-to-metal adhesives
ABS "Hi Impact" resins
Personnel: Robert Shattuck, mgr.; J. F. Showalter, supt.

MARBON CHEMICAL DIV.—BORG-WARNER CORP.
Washington, W. Va.
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Acrylonitrile
Butadiene
Styrene
Products and output:
ABS high impact resins
Personnel: Robert Shattuck, mgr.; Byron Bailey, supt.; Carl Taylor, chf. engr.
Remarks: Commenced operations March, 1957.

THE MERICHEM CO. (Div., Jefferson Lake Sulphur Co.)
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Cresylic acid
Phenol
Cresols
Personnel: J. I. Files, v.p.; J. D. Ligon, plt. mgr.; L. J. Jolly, supt.
Remarks: $1 million expansion program under construction. Engrs., Tears; contrs., Brown & Root.

MISSISSIPPI CHEMICAL CORP.
Yazoo City, Miss.
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—95,000 ton/yr.
Nitric acid—114,000 ton/yr.
Ammonium nitrate—160,000 ton/yr.
Personnel: W. B. Dunwoody, genl. oper. mgr.; J. R. Phillips, asst. genl. mgr.; J. D. Drake, chf. engr.

MISSISSIPPI RIVER CHEMICAL CO. (Div., Mississippi River Fuel Corp.)
Selma, Mo.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—72,000 ton/yr.
Nitric acid—79,200 ton/yr.
Ammonium nitrate—100,800 ton/yr.
Personnel: C. H. Lashlee, plt. mgr.

MOBAY CHEMICAL CO.
New Martinsville, W. Va.
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Toluene diamine
Adipic acid
Ethylene glycol
Products and output:
Isocyanates
Polyesters
Butylene glycol
Phthalic anhydride
Personnel: D. J. Miller, plt. mgr.; R. F. Cassidy, prod. supt.
Remarks: Company is owned jointly by Monsanto Chemical Co. and Farbenfabriken Bayer A. G. of Germany. Isocyanates and polyesters capacities are being tripled. Blaw-Knox holds construction contract.

MONSANTO CHEMICAL CO.
Avon, Calif.
Approximate investment: $5,000,000
Hydrocarbon raw materials:
Benzene
Acid sludge
Products and output:
Phenol—20 million lb./yr.
Sulfuric acid—80,000 ton/yr.
Personnel: P. W. Edwards, mgr.
Remarks: Acid operation is jointly with Tidewater Oil Co. Sulfur is also used as part of feed, besides acid sludge and sour gas.

MONSANTO CHEMICAL CO.
Texas City, Texas
Approximate investment: $15,300,000 (for vinyl chloride and methanol only)
Hydrocarbon raw materials:
Benzene
Ethylene
Methane
Propane
Natural gas
Products and output:
Hydrogen cyanide
Styrene monomer—140,000 ton/yr.
Vinyl chloride
Acrylonitrile
Polyethylene—66 million lb./yr.
Methanol—25 million gal./yr.
Acetylene
Tertiary butylamine
Ethyl benzene
Ethylene dichloride
Personnel: J. S. Putnam, plt. mgr.; H. K. Eckert, dir. of mfg.
Remarks: Methanol unit operated by Monsanto and Heyden Newport Chemical Co. 150% ethylene expansion program completed early '57. N-butane, ethylene plant being built for internal use.

MONSANTO CHEMICAL CO.
(Lion Oil Co. Division)
El Dorado, Ark.
Approximate investment: $40,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia
Ammonium sulfate
Ammonium nitrate
Fertilizer solutions
Nitric acid
Sulfuric acid
Personnel: A. M. Sprague; G. D. Rucker, asst. mgr.

MONSANTO CHEMICAL CO.
(Lion Oil Co. Division)
Luling, La. (Barton plant)
Approximate investment: $31,000,000
Hydrocarbon raw materials:
Natural gas
Waste gases
Products and output:
Anhydrous ammonia
Ammonium nitrate
Dry ice and liquid CO_2
Nitric acid
Personnel: R. L. Van Zandt, mgr.; S. B. Johnson, asst. mgr.

MONTANA SULPHUR & CHEMICAL CO.
Billings, Mont.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur—40 ton/day
Personnel: D. G. Zink, pres.; J. R. Butler, v.p.
Remarks: In operation since June, 1956. Plant uses gas from Carter Oil Co. and Continental Oil Co. refineries at Billings, Mont.

MONTROSE CHEMICAL CO.
Newark, N. J.
Hydrocarbon raw materials:
Cresylic acid
Products and output:
Tricresyl phosphate
Personnel: B. Rothberg, v.p.; F. G. Radis, supt.

MORTON-WITHERS CHEMICAL CO.
Greensboro, N. C.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sulfonates
Synthetic lubes
Lube oil additives
Total—20 million lb./yr.
Personnel: R. T. Masters, supt.

MOUNTAINEER CARBON CO.
Cresap, W. Va.
Approximate investment: $1,500,000
Hydrocarbon raw materials:
Petroleum coke
Products and output:
Electrode carbon—165,000 ton/yr.
Personnel: N. E. Sylvander is overall project mgr.
Remarks: Parents, Standard Oil Co. (Ohio) and Pittsburgh Consolidation Coal Co. Feed is initially petroleum coke from Sohio. At a later date, coke similar to petroleum coke, will be produced from low temperature tar. Plant to start Jan., 1958.

N

NATIONAL PETRO-CHEMICALS CO.
Tuscola, Ill.
Approximate investment: $70,000,000
Hydrocarbon raw materials:
Ethylene
Natural gas
Products and output:
Ethyl alcohol—40 million gal./yr.
Ethyl chloride—60 million lb./yr.
Polyethylene—50 million lb./yr.
Ether—4.5 million gal./yr.
Personnel: J. W. Nixon, mgr.; C. E. Oman, proc. supt.; C. D. Carnes, chf. engr.
Remarks: Parent companies, National Distillers & Chemical Co (60%) and Pan Handle Eastern Pipe Line Co. (40%). Ethylene capacity increased to 450 ton/day and polyethylene (both high and low density) to 100,000 lb./yr. Onstream March 1957, Engr.-contr. was Kellogg, licensor, ICI.

NATURAL GAS ODORIZING, INC.
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Mercaptans
Gas odorants
Personnel: W. M. Wilkinson, pres.; W. H. Dickerson, plt. mgr.

NECHES BUTANE PRODUCTS CO.
Port Neches, Texas
Approximate investment: $53,000,000★
Hydrocarbon raw materials:
Butylenes
Products and output:
Butadiene—200,000 short ton/yr.
Personnel: W. H. Hoffman, pres.; M. L. Rosenberg, v.p.; R. S. Crockett, v.p.; F. R. Jelinck, chf. engr.
Remarks: ★Purchase price from U. S. Government. Owned 50-50 by Texas-U. S. Chemical Co. and Goodrich-Gulf Chemical Co. Expansion of butadiene plant from 200 to 300 thousand short ton/yr. to be completed by fall of 1957.

NEVILLE CHEMICAL CO.
Anaheim, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Hydrocarbon resins
Aromatic solvents
Personnel: R. L. Ulrich, mgr.; J. Christianson, supt.

NEVILLE CHEMICAL CO.
Neville Island (Pittsburgh) Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Hydrocarbon resins
Aromatic solvents
Personnel: L. V. Dauler, pres.; J. Shearer, supt.; L. J. Sitomer, chf. engr.

NEWPORT INDUSTRIES, INC.
Now Newport Industries Co., a division of Heyden Newport Chemical Corp.

NEWPORT INDUSTRIES CO.
(Div., Heyden Newport Chemical Corp.)
Pensacola, Fla.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen
Personnel: H. L. Marter, v.p.-prod.; R. F. Cole, chf. engr.
Remarks: Hydrogen produced by catalytic steam-reforming unit. Formerly Newport Industries, Inc.

NINOL LABORATORIES
Chicago, Ill.
Approximate investment: $750,000
Hydrocarbon raw materials:
Alkylated benzene
Products and output:
Special sulfonates—15 million lb./yr.
Personnel: Jerome Kritchevsky, pres.

NOPCO CHEMICAL CO.
Richmond, Calif.
Hydrocarbon raw materials:
Crude petroleum sulfonates
Naphthenates
Products and output:
Naphthenic acid
Lube oil additives
Polyvinyl acetate emulsions
Plasticizers
Personnel: J. E. Connelly, mgr.
Remarks: Formerly Griffin Chemical Co.

NORTHERN CHEMICAL INDUSTRIES, INC.
Searsport, Maine
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Bunker C fuel oil
Products and output:
Anhydrous ammonia—45,000 ton/yr.
Nitric acid—21,600 ton/yr.
Mixed fertilizer—50,000 ton/yr.
Sulfuric acid—70,000 ton/yr.
Personnel: F. L. Litty, mgr.; G. Odom, chf. engr.
Remarks: Use Texaco partial oxidation process. Onstream late 1956.

NUODEX PRODUCTS CO.
Long Beach, Calif.
Hydrocarbon raw materials
Petroleum derivatives
Products and output:
Naphthenates
Fungicides
Bactericides
Additives
Personnel: A. J. Roubo, mgr.
Remarks: Parent, Heyden Newport Chemical Corp.

NUODEX PRODUCTS CO.
Elizabeth, N. J.
Hydrocarbon raw materials:
Petroleum derivatives
Products and output:
Naphthenates
Fungicides
Bactericides
Additives
Personnel, J. F. Kilcullen, mgr.
Remarks: Parent, Heyden Newport Chemical Corp.

NUODEX PRODUCTS CO.
Newark, N. J.
Hydrocarbon raw materials:
Petroleum derivatives
Products and output:
Naphthenates
Fungicides
Bactericides
Additives
Personnel: R. A. Allen, mgr.
Remarks: Parent, Heyden Newport Chemical Corp.

O

ODESSA BUTADIENE CO.
Odessa, Texas
Hydrocarbon raw materials:
Butane
Benzene
Products and output:
Butadiene—50,000 ton/yr.
Styrene—35 million lb./yr.
Personnel: W. W. Mize, mgr.; D. C. Klein, asst. mgr.; M. Atcheson, chf. engr.
Remarks: El Paso Natural Gas Products Co., majority owner and operator. Butadiene to be onstream about Aug. 1957 and styrene plant onstream early 1958. Total cost of both plants $27 million.

OLIN MATHIESON CHEMICAL CORP.
Magnolia, Ark.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: O. W. Taylor, mgr.

OLIN MATHIESON CHEMICAL CORP.
McKamie, Ark.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: O. W. Taylor, mgr.

OLIN MATHIESON CHEMICAL CORP.
Brandenburg, Ky.
Hydrocarbon raw materials:
Ethane (from natural gas)
Products and output:
Ethylene oxide
Ethylene glycol
Diethylene glycol
Ethylene dichloride
Triethylene glycol
Polyglycols
Glycol ethers
Ethanolamines
Dichlorethyl ether
Ethylene diamine
Polyamines
Personnel: C. J. Thomas, mgr.; C. C. Hale, mgr. of engrg.

OLIN MATHIESON CHEMICAL CORP.
Lake Charles, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—95,000 ton/yr.
Nitric acid
Sodium nitrate
Hydrazine
Personnel: C. C. Hightower, mgr.; W. C. Moseley, asst. mgr.; A. D. Hargrader, chf. engr.

ORONITE CHEMICAL CO.
Oak Point, La.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Furnace oil additives
Gas odorants
Nonionic detergents
Algicides
Alkyl phenols
Lube oil additives
Personnel: W. K. Venatta, mgr.; F. A. Tannahill, supt.
Remarks: Parent, California Chemical Co., a subsidiary of Standard Oil Co. of Calif.

P

PAN AMERICAN PETROLEUM CORP.
North Cowden, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—6,200 ton/yr.
Personnel: E. R. Wagner, supt.
Remarks: Formerly Stanolind Oil & Gas Co. Parent, Standard Oil Co. (Ind.)

PAN AMERICAN PETROLEUM CORP.
Odessa, Texas
Hydrocarbon raw materials:
Hydrogen sulfide
Products and output:
Sulfur—3,650 ton/yr.
Personnel: L. E. Childers, supt.
Remarks: Formerly Stanolind Oil & Gas Co. Parent, Standard Oil Co. (Ind.) Sulfur recovery unit added to existing Midland Farms Gasoline Plant, completed Sept. 1956.

PAN AMERICAN PETROLEUM CORP.
Sundown, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—17,150 ton/yr.
Personnel: H. K. Boswell, supt.
Remarks: Formerly Stanolind Oil & Gas Co. Parent, Standard Oil Co. (Ind.)

PAN AMERICAN PETROLEUM CORP.
Powell, Wyo. (Elk Basin Field)
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—23,700 ton/yr.
Personnel: A. H. Denny, supt.
Remarks: Formerly Stanolind Oil & Gas Co. Parent, Standard Oil Co. (Ind.)

PAN-AM SOUTHERN CORP.
Merged into American Oil Co., by parent, Standard Oil Co. (Ind.)

PATHFINDER CHEMICAL CO.
Taken into parent company, Goodyear Tire & Rubber Co., on Jan. 1, 1957. Now known as the Niagara Falls Plant of Goodyear.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.
Chester, Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum resins
Toluol
Xylol
Aromatic naphthas
Naphthalene
Aromatic oils
Personnel: J. D. Vermeychuk, supt.; W. D. Johnston, chf. engr.
Remarks: This is a small 100,000 gal./yr. plant.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.
Clariton, Pa. (West Elizabeth)
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Styrene
Petroleum resins
Aromatic solvents
Personnel: E. A. Taylor, mgr.
Remarks: West Elizabeth operates on variety of materials, petroleum and coal-tar derivatives, and acts as "feeder" to main plant at Clariton, where all raw materials are coal-tar at present.

PENNSYLVANIA REFINING CO.
Karns City, Pa.
Approximate investment: $500,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum sulfonate—5 million lb./yr.
Personnel: John Beck, mgr.; C. M. McCullough, supt.

PENNSALT CHEMICALS CORP. (Industrial Div.)
Riverview, Mich.
Hydrocarbon raw materials:
Pentane
Tri-isobutylene
Products and output:
Amyl alcohol
Amyl chloride
Amyl acetate
Amyl phenols
Amyl naphthalenes
Tert-dodecylmercaptan
Personnel: H. J. Eichenhofer, area mgr., R. V. Laitner, prod. mgr.; L. A. Gillette, tech. mgr.

PENNSALT CHEMICALS CORP. (Industrial Div.)
Wyandotte, Mich.
Hydrocarbon raw materials:
Pentane fractions
Tri-isobutylene
Products and output:
Pentane—1 & 2 mixed pentanes
Amyl alcohol
Amyl chloride
Amyl acetate
Amyl phenols
Amyl naphthalenes
Amyl mercaptan
Tert-dodecylmercaptan
Tert-dodecylether
Polyethylene glycol
Remarks: Formerly Sharples Chemical Div. of Pennsalt.

PETROCARBON CHEMICALS, INC.
Irving, Texas
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Crude oil
Products and output:
Aliphatic solvents
Aromatic solvents
Personnel: J. Shoaf, supt.; John Hearne, chf. engr.

PETROLEUM CHEMICALS, INC.
Lake Charles, La.
Approximate investment: $22,500,000
Gross value products: 1957 (est.)—$24,000,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Butadiene—80,000 ton/yr.
Personnel: Bruce K. Brown, pres.; F. M. Simpson, exec. v.p.; J. H. Olehy, genl. mgr.-mfg.; L. D. Grubb, regional mgr.-Lake Charles.
Remarks: A 100,000 ton/yr. anhydrous ammonia plant is being built by the Foster Wheeler Corp. at an estimated cost of $12.5 million and is scheduled for completion in the fall of 1957. A 200 million lb./yr. ethylene plant is being built by Lummus Co. and is scheduled for completion the first of 1958. Engineering work by the Foster Wheeler Corp. is being done for a 30,000 ton/yr. butyl rubber plant. PCI is building for the account of the Calcisieu Chemical Corp., an 8 million gal./yr. ethylene glycol plant. The contractor is Lummus Co.

PETRO-TEX CHEMICAL CORP.
Houston, Tex.
Hydrocarbon raw materials:
Butane
Butylene
Products and output:
Butadiene-1, 3—200,000 ton/yr.
n-Butylene-1
n-Butylene-2
Personnel: J. O'C. Brown, mgr.; D. V. Fitz, supt.; L. L. Hess, plt. engr. and maint. supt.
Remarks: Petro-Tex is jointly and equally owned by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp. Two Houdry n-butane dehydrogenation units completed April 1957 are producing additional 110,000 short ton/yr. butadiene.

PHILLIPS CHEMICAL CO.
Andrews County, Texas
Remarks: Plans deferred for sulfur-from-natural gas plant here.

PHILLIPS CHEMICAL CO.
Big Spring, Texas
Hydrocarbon raw materials:
Mixed xylenes
Products and output:
Paraxylene—3,540,500 lb./yr.
Personnel: A. F. Legatski, supt.
Remarks: Subsid. of Phillips Petroleum Co. Plant operated by Cosden Petroleum Corp.

PHILLIPS CHEMICAL CO.
Borger, Texas
Hydrocarbon raw materials:
Gas oil
Products and output:
Furnace blacks Philback—290 million lb./yr.
Personnel: H. E. Haltom, supt.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Borger, Texas
Hydrocarbon raw materials:
Butane
Styrene
Butadiene
Products and output:
Butadiene—110,000 short ton/yr.
SBR rubber, Philprene—108,000 long ton/yr.
Personnel: G. H. Short, mgr.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Crane County, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—36,500 long ton/yr.
Personnel: A. F. Legatski, supt.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Etter, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—191,600 ton/yr.
Ammonium nitrate—142,000 ton/yr.
Nitrogen solutions—55,000 ton/yr.
Nitric acid—130,000 ton/yr.
Personnel: C. W. Forman, supt.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Goldsmith, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—36,500 long ton/yr.
Personnel: A. F. Legatski, supt.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Pasadena, Texas
Hydrocarbon raw materials:
Ethylene
Natural gas
Methylethylpyridine
Products and output:
Rigid polyethylene, Marlex 50—75 million lb./yr.*
Ammonia—191,600 ton/yr.
Ammonium sulfate—365,000 ton/yr.
Triple superphosphate—147,800 ton/yr.
Methylvinylpyridine—3 million lb./yr.
Personnel: L. H. Johnstone, mgr.
Remarks: * Capacity of facilities to be completed in 1957. Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Sweeny, Texas
Hydrocarbon raw materials:
Butane and/or propane
Products and output:
Ethylene—180 million lb./yr.
Personnel: G. A. Ibach, supt.
Remarks: Subsid. of Phillips Petroleum Co.

PHILLIPS CHEMICAL CO.
Gulf Coast location
Remarks: Plans for 64 million lb./yr. carbon black-from-oil plant here deferred.

PHILLIPS PACIFIC CHEMICAL CO.
Kennewick, Wash.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—73,000 short ton/yr.
Personnel: W. D. Payton, supt.
Remarks: Jointly owned by Phillips Petroleum Co. and Pacific Pipeline Corp. Operated by Phillips Chemical Co.

PHILLIPS PETROLEUM CO.
Kansas City, Kan.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Rubber extender and process oils
Personnel: C. V. Cavin, plt. supt.

PHILLIPS PETROLEUM CO.
Phillips, Texas (Borger Fractionator)

Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Diisopropyl
Cyclohexane
Hydrogen sulfide
Hydrofluoric alkylate
Ethyl mercaptan
Personnel: A. W. Paris, dist. supt.

PHILLIPS PETROLEUM CO.
Phillips Texas (Philtex Plant)
Hydrocarbon raw materials:
Petroleum and natural gas fractions
Products and output:
Methane
Ethane
Propane
Isobutane
n-Butane
Neopentane
Isopentane
n-Pentane
Neohexane
Diisopropyl
2-Methylpentane
3-Methylpentane
n-Hexane
2,4-Dimethylhexane
2,3-Dimethylhexane
3-Methylhexane
n-Heptane
2,2,4-Trimethylheptane
n-Octane
Dimethylhexanes
Trimethylpentanes
2,2,5-Trimethylhexane
n-Nonane
n-Decane
n-Undecane
Tridecane
Ethylene
Propylene
Isobutylene
Butene-1
cis-Butene-2
trans-Butene-2
3-Methylbutene-1
Pentene-1
2-Methylbutene-1
Pentene-2
2-Methylbutene-2
4-Methylpentene-1
4-Methylpentene-2
2-Methylpentene-1
Hexene-1
Hexene-2
Hexene-3
Heptene-2
Heptene-3
2,4,4-Trimethylpentene-1
Octene-1
Octene-2
2,6-Dimethylheptene-3
Cyclopentane
Methylcyclopentane
Methlycyclohexane
Cyclopentene
Cyclohexene
4-Methylcyclohexene-1
4-Vinylcyclohexene-1
1-Phenylbutene-2
1,5-Cyclooctadiene
Butadiene-1,3
Liquid Polybutadiene (Butarez)
Isoprene
Pentadiene-1,3
Benzene
Toluene
Ethylbenzene
para-Xylene
meta-Xylene
ortho-Xylene
Cumene
1,2,4-Trimethylbenzene
tert-Butylbenzene
sec-Butylbenzene
n-Butylbenzene
Butadiene-furfural cotrimer
tert-Butyl mercaptan
tert-Amyl mercaptan
Hexyl mercaptan
tert-Heptyl mercaptan
tert-Octyl mercaptan
tert-Nonyl mercaptan
tert-Dodecyl mercaptan
tert-Tetradecyl mercaptan
tert-Hexadecyl mercaptan
Phenylethyl mercaptan
Diphenylethyl sulfide
Ditertiarybutyl sulfide
Diethyl disulfide
Ditertiarybutyl disulfide
Ditertiaryamyl disulfide
Ditertiaryhexyl disulfide
Ditertiaryheptyl disulfide
Ditertiarydodecyl disulfide
Ditertiarytetradecyl disulfide
Ditertiarybutyl polysulfide
Ditertiaryamyl polysulfide
Ditertiaryoctyl polysulfide
Ditertiarydodecyl polysulfide
Diisobutylene
Cyclohexane
Odorless solvents (Soltrols)
Precipitation and dilution naphthas
Petroleum ether
Personnel: A. A. Roho, plt. supt.

PITT-CONSOL CHEMICALS CO.
Newark, N. J.
Approximate investment: $3,500,000
Hydrocarbon raw materials:
Refinery fractions, mainly spent caustics
Products and output:
Cresols
Cresylic acid
Phenols
Resins
Personnel: R. H. Martin, genl. mgr.; R. L. Comstock, plt. supt.; E. T. Rudy, chf. engr.
Remarks: Formerly Reilly Tar & Chemical Co. plant, bought by Pitt-Consol in September, 1955.

PRODUCTOL CO.
Santa Fe Springs, Calif.
Hydrocarbon raw materials:
Petroleum and coal tar fractions
Products and output:
Phenol
Cresols
Cresylic acids
Naphthalene
Personnel: E. E. Chipman, mgr.; J. W. Burrow, supt.

PURE OIL CO.
Lemont, Ill.
Approximate investment: $300,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur—5,250 ton/yr.
Personnel: J. M. Lawson, mgr.

PURE OIL CO.
Toledo, Ohio
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Toluene—2°
Xylene
Aromatic fractions
Solvents
Personnel: H. H. Dronberger, mgr.

PURE OIL CO.
Nederland, Texas
Hydrocarbon raw materials:
Petroleum fractions
Refinery gas streams
Products and output:
Lube oil additives
Solvents
1-Butene
2-Butene
Butene mixtures
Petroleum and condensation resins
Non-paraffin concentrates
Personnel: C. W. Cooper, mgr.; I. L. Hostetler, genl. supt.

PUREX CORP.
South Gate, Calif.
Hydrocarbon raw materials:
Propylene
Products and output:
Sulfonated alkyl benzene
Personnel: S. M. Dahl, prod. mgr.

PUREX CORP.
St. Louis, Mo.
Hydrocarbon raw materials:
Propylene
Products and output:
Sulfonated alkyl benzene
Personnel: B. Rich, mgr.

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QUAKER CHEMICAL PRODUCTS CORP.
Conshohocken, Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Detergents
Metal cleaners
Textile finishing compounds
Corrosion preventives
Personnel: Wm. J. Gavin, mgr.

REICHHOLD CHEMICALS CO.
Tuscaloosa, Ala.
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Methanol
Formalin-acetaldehyde
Benzene
Products and output:
Pentaerythritol—5 million lb./yr.
Formaldehyde—30 million lb./yr.
Synthetic resins
Phenol—50 million lb./yr.
Personnel: W. O. Fetterly, plt. mgr.; B. F. Galloway, supt.
Remarks: Pentaerythritol production to be doubled and phenol increased 50% to 75-million lb./yr. Also will build a new 35-million lb./yr. formaldehyde unit. Construction by staff.

REICHHOLD CHEMICALS CO.
Azusa, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Phthalic anhydride—10 million lb./yr.
Personnel: J. H. Zeller, mgr.; J. E. Jared, supt.
Remarks: 10 million lb./yr. phthalic anhydride plant onstream July, 1957.

REICHHOLD CHEMICALS CO.
San Francisco, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: M. W. Reece, genl. mgr.; S. W. Small, plt. mgr.; C. A. Koski, supt.

REICHHOLD CHEMICALS CO.
Jacksonville, Fla.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: R. B. Fellows, mgr.

REICHHOLD CHEMICALS CO.
Pensacola, Fla.
Hydrocarbon raw materials:
Methanol
Remarks: Plant financed and wholly owned by Escambia Chemical Corp. Reichhold takes total output for its own internal usage and for general marketing.

REICHHOLD CHEMICALS CO.
Ballardvale, Mass.
Hydrocarbon raw materials:
Petroleum fractions
Methanol
Products and output:
Synthetic resins
Formaldehyde
Personnel: R. T. Urich, genl. mgr.; H. F. Shepard, plt. mgr.

REICHHOLD CHEMICALS CO.
Detroit, Mich.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Phthalic anhydride—8,000,000 lb./yr.
Personnel: C. J. Windsor, mgr.; J. W. Milford, supt.
Remarks: Company engineering staff to build a 35 million lb./yr. formaldehyde unit. Completion date early '58.

REICHHOLD CHEMICALS CO.
Elizabeth, N. J.
Hydrocarbon raw materials:
Petroleum fractions
Benzene
Products and output:
Synthetic resins
Maleic anhydride—2 million lb./yr.
Personnel: J. E. d'Angelo, mgr.; C. G. Matko, chf. engr.
Remarks: Company has plans for $10 million expansion throughout all plants, including following product capacity expansions: phenol, pentaerythritol, phthalic anhydride, maleic anhydride, formaldehyde, glycerine. Engineering & construction by staff. No completion date set.

REICHHOLD CHEMICALS CO.
Charlotte, N. C.
Hydrocarbon raw materials:
Petroleum fractions
Methanol
Products and output:
Synthetic resins
Formaldehyde
Personnel: G. D. Hanner, supt.

REICHHOLD CHEMICALS CO.
Seattle, Wash.
Hydrocarbon raw materials:
Petroleum fractions
Phenol (chlorinated)
Products and output:
Synthetic resins
Formaldehyde
Pentachlorophenol—360,000 lb./yr.
Personnel: H. O. Warner, plt. mgr.; C. E. Ruiga, chf. engr.

REICHHOLD CHEMICALS CO.
Tacoma, Wash.
Hydrocarbon raw materials:
Benzene
Products and output:
Phenolic resins

Pentachlorphenol—4,000,000 lb./yr.
Plywood glues—24,000,000 lb./yr.
Formaldehyde
Personnel: H. O. Warner, plt. mgr.; R. Rose, supt.; C. E. Ruiga, chf. engr.
Remarks: Plant onstream since April, 1956. The new formaldehyde plant was completed April, 1957.

REPUBLIC OIL REFINING CO.
Texas City, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Propylene tetramer—16,500,000 lb./yr.
Propylene trimer—24.4 million lb./yr.
Personnel: L. W. Robbie, v.p. and mgr.; M. E. Houser, supt.; H. Howell, ch. engr.
Remarks: 5,000 b./d. Udex unit in design stages. Construction to begin last quarter '57. Proposed output: 370 b./d. benzene; 900 b./d. toluene; 750 b./d. xylenes.

RICHFIELD OIL CORP. (Watson Refinery)
Los Angeles County, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Hydrogen sulfide—56 million lb./yr.
Ethylene—25 million lb./yr.
Personnel: C. R. McKay, mgr.; R. P. Corlew, asst. mgr.
Remarks: Company plans to spend $500,000 to increase capacity for sulfur recovery.

ROHM & HAAS CO.
Pasadena (Deer Park), Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen cyanide
Acetone cyanhydrin
Acrylic chemicals
Higher alcohols
Personnel: V. C. Henrich, mgr.; D. W. Kenny, asst. to mgr.; R. Ayres, chf. engr.
Remarks: Company is planning a $10 million unit to make acetylene from natural gas, with capacity of about 20 million lb./yr. Will use Texaco-Hydrocarbon Research partial oxidation process. Also planning 100 ton/d. methanol plant; licensor, Texaco; engineer contractor, Foster Wheeler.

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ST. PAUL AMMONIA PRODUCTS, INC.
Pine Bend, Minn.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas and residual oil
Products and output:
Ammonia—70,000 ton/yr.
Ammonium nitrate
Personnel: Frank W. Wilson, genl. mgr.
Remarks: Output of plant will be sold to Central Farmers Fertilizer Co. Plant is scheduled for completion Aug. 1, 1957. Engineer contractor is Lummus Co. Will use the Texaco process.

SAN JACINTO CHEMICAL CO.
Houston, Texas
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—43,200 ton/yr.
Personnel: R. F. Hopkins, pres.; D. A. White, mgr.; S. M. Pamplin, prod. supt.; A. L. Isham, chf. engr.
Remarks: Parent, Smith Douglas Co., Inc., of Norfolk, Va.

SEABOARD OIL CO.
Powell, Wyo.
Approximate investment: $1,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—9,000 ton/yr.
Personnel: W. R. Strong, foreman.

SHAMROCK OIL GAS CORP.
Sunray, Texas
Approximate investment: $285,000
Hydrocarbon raw materials:
Acid gases
Products and output:
Sulfur—10,800 ton/yr.
Personnel: A. V. Beckworth, supt.; G. L. Wherry, chf. engr.

SHAWINIGAN RESINS CORP.
Trenton, Mich.
Approximate investment: $1,000,000 plus
Products and output:
Vinyl butyral resins, Butvar
Personnel: L. F. Davis, plt. mgr.
Remarks: Completion scheduled for Oct., 1957. Parents, Monsanto Chemical Co. and Shawinigan Chemicals, Ltd.

SHELL CHEMICAL CO.
Dominguez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohols
Solvents
Other organic chemicals
Personnel: O. M. Williams, mgr.

SHELL CHEMICAL CORP.
Martinez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohol
Solvents
Trisubstituted phenol
p-tert. butybenzene acid
Lube oil additives
Personnel: E. W. Casagrande, mgr.

SHELL CHEMICAL CO.
Pittsburg, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia
Ammonium sulfate
Carbon black
Catalysts
Diammonium phosphate
Personnel: G. S. Williamson, mgr.

SHELL CHEMICAL CO.
Torrance, Calif.
Approximate investment: $30,000,000
Hydrocarbon raw materials:
Butylenes
Benzene
Propane
Products and output:
Butadiene—70,000 short ton/yr.
Styrene
GR-S rubber—110,000 long ton/yr.
Personnel: M. Voogd, mgr.
Remarks: Cost and capacities are those reported at time of purchase of this plant from government, spring, 1955. Additional amounts have since been invested to increase efficiency and versatility of plant.

SHELL CHEMICAL CO.
Ventura, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—65,000 ton/yr.
Urea—36,000 ton/yr.
Personnel: F. D. Kuenzly, mgr.

SHELL CHEMICAL CO.
Denver, Colo.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aldrin
Dieldrin
Endrin
"Nemagon" nematocide
Methyl parathion
Insecticide "Phosdrin"
Specialty chemicals
Personnel: H. E. Hughes, mgr.

SHELL CHEMICAL CORP.
Norco, La.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Crude chlorohydrins
Allyl chloride, "D-D"
Soil fumigant, "D-D"
Hydrogen peroxide
Acrolein
Glycerine—30 million lb./yr.
Personnel: F. E. Caddy, mgr.
Remarks: Peroxide unit is under construction, for late 1957 completion. A 40,000,000 lb./yr. methyl ethyl ketone unit is under construction, due for completion fall of 1957. Acrolein and glycerine units planned.

SHELL CHEMICAL CORP.
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohols
Solvents
Soil fumigant, "D-D"
Epon resins
Glycerine
Bis-phenol A
Personnel: Glenn Purcell, mgr.

SHELL OIL CO.
Martinez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
1-Butene
2-Butene
Petroleum sulfonates
Personnel: Bruno Stolley, mgr.

SHELL OIL CO.
Wilmington, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene—6 million gal./yr.
Cresylic acid
Toluene
Xylenes
Mixed xylenes
Cyclohexane
1-Butene
2-Butene
Personnel: J. P. Merkus, Jr., mgr.

SHELL OIL CO.
Wood River, Ill.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Toluene
Xylene
Personnel: H. D. Dale, mgr.

SHELL OIL CO.
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene—19,000,000 gal./yr.
Toluene—33,000,000 gal./yr.
Sulfur—20,000 ton/yr.
Personnel: J. A. Tench, mgr.

SID RICHARDSON CARBON CO.
Odessa, Texas
Approximate investment: $8,000,000
Hydrocarbon raw materials:
Natural gas
Hydrogen sulfide
Products and output:
Carbon black, Texas blacks—70 million lb./yr.
Sulfur—5,000 ton/yr.
Personnel: H. H. Offutt, mgr.; L. E. King, supt.; G. McClure, chf. engr.

SID RICHARDSON GASOLINE CO.
Kermit, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—10 ton/d.
Natural gasoline
Butanes
Propane
Personnel: D. H. Huff, mgr.; S. L. Humphreys, supt.; G. McClure, chf. engr.
Remarks: Cycling—planning.

SID RICHARDSON GASOLINE CO.
Kermit, Texas
Approximate investment: $9,000,000
Hydrocarbon raw materials:
Natural gas
Hydrogen sulfide
Products and output:
Propane—550,000 b./yr.
Butane—400,000 b./yr.
Natural gasoline—450,000 b./yr.
Sulfur—2,500 ton/yr.
Personnel: S. L. Humphreys, mgr.; H. G. Holmes, supt.; G. P. McClure, chf. engr.

SIGNAL OIL & GAS CO.
Tioga, N. Dak.
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Casinghead gas
Products and output:
Sulfur
Personnel: R. L. Cook, supt.; F. W. Norton, chf. engr.

SINCLAIR REFINING CO.
Wood River, Ill.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aromatic solvents
Personnel: M. H. Nolan, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
East Chicago, Ind.
Hydrocarbon raw materials:
Petroleum fractions

Products and output:
Lube oil additives
Cresylic acids
Antioxidants
Aromatic solvents
Gear, turbine and cutting oil additives
Personnel: G. A. Blaine, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
Wellsville, N. Y.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum resins
Personnel: W. B. Chenault, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
Sand Springs, Okla.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Demulsifying agents
Corrosion inhibitors
Sulfonates, acid and oil layer types (sodium salt)
Personnel: J. G. Wisherd, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
Marcus Hook, Pa.
Hydrocarbon raw materials:
Catalytic reformate
Petroleum fractions
Refinery gas
Products and output:
Toluene
Paraxylene (98%)
Mixed xylenes
High aromatic solvents
Dodecene
Cresylic acids
Sulfur
Personnel: R. J. Self, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
Corpus Christi, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aromatic solvents
Personnel: E. B. Killick, mgr.
Remarks: Sales affiliate, Sinclair Chemicals, Inc., a subsidiary of Sinclair Oil Corp.

SINCLAIR REFINING CO.
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Refinery gases
Products and output:
Sulfonates (barium, calcium and sodium salts)
Corrosion inhibitors
Isoparaffinic odorless solvents
Cresylic acids
Sulfur
Personnel: J. D. Seifer, mgr.

SOCONY MOBIL OIL CO., INC.
East St. Louis, Ill.
Hydrocarbon raw materials:
Refinery streams
Products and output:
Sodium cresylate solutions
Personnel: H. A. Lutz, mgr., L. J. Keenan, chf. engr.

SOCONY MOBIL OIL CO., INC.
East Chicago, Ind.
Hydrocarbon raw materials:
Refinery streams
Products and output:
Sodium cresylate solutions
Hydrogen
Personnel: W. W. Reed, mgr.; J. W. Mann, oper. supt.; L. L. Claassen, chf. engr.

SOCONY MOBIL OIL CO., INC.
Augusta, Kans.
Products and output:
Hydrocarbon fractions
Personnel: H. B. Caldwell, Jr., mgr.

SOCONY MOBIL OIL CO., INC.
Trenton, Mich.
Products and output:
Hydrocarbon fractions
Sodium cresylate solutions
Personnel: T. S. Lennox, mgr.

SOCONY MOBIL OIL CO., INC.
Paulsboro, N. J.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sodium cresylate solutions
Sodium sulfide solutions
Propylene
Personnel: L. E. Cranston, mgr.; H. D. Chapman, oper. supt.

SOCONY MOBIL OIL CO., INC.
Brooklyn, N. Y.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sodium cresylate solutions
Personnel: D. P. Parker, mgr.; F. R. Gohlke, chf. engr.

SOCONY MOBIL OIL CO., INC.
Buffalo, N. Y.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sodium sulphide
Sodium cresylate solutions
Personnel: T. C. Lockhart, mgr.

SOCONY MOBIL OIL CO., INC.
Casper, Wyo.
Products and output:
Hydrocarbon fractions
Petrochemical products
Personnel: E. T. Pummill, mgr.

SOHIO PETROLEUM CO.
Lima, Ohio
Approximate investment: $18,000,000
Petrochemical raw materials:
Natural gas
Refinery off-gas
Products and output:
Anhydrous ammonia—300 ton/d.
Nitric acid
Urea
Carbon dioxide (liquid and solid)
Ammonium nitrate
Nitrogen solutions
Personnel: D. J. Stevens, plt. mgr.
Remarks: Subsid. of Standard Oil Co. (Ohio).

L. SONNEBORN SONS, INC.
Petrolia, Pa.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sulfonates (oil layer type)
Sulfonates (water soluble)
Coke
Personnel: H. Schindler, mgr.; A. W. Straube, chf. engr.
Remarks: Coke from Miley-Monsanto-Sonneborn sludge decomposition process.

SOUTHERN NITROGEN CO., INC.
Savannah, Ga.
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—90,000 ton/yr.
Nitric acid
Urea
Nitrogen solutions
Prilled ammonium nitrate
Personnel: J. R. Riley, pres.; R. F. Brown, v.p.-operations; N. S. Whitaker, prod. mgr.
Remarks: Will use gas supplied by Southern Natural Gas Co. of Birmingham, Ala. Plant is scheduled for completion in 1957. Contractor, Girdler Co.

SPENCER CHEMICAL CO.
Calumet City, Ill.
Hydrocarbon raw materials:
Methanol
Ammonia
Products and output:
Formaldehyde
Hexamine
Aqua ammonia
Personnel: R. W. McKinney, mgr.; L. T. Landrum, supt.
Remarks: Methanol feedstock comes from Pittsburg, Kans., plant. $120,000 expansion of formaldehyde capacity by Quaker completed Jan., 1957.

SPENCER CHEMICAL CO.
Pittsburg, Kans.
Approximate investment: $11,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—178,000 ton/yr.
Methanol
Ammoniating solutions
Ammonium nitrate
Nitric acid
Carbon dioxide
Personnel: V. F. Hobart, mgr.; W. R. McCluskey, prod. supt.

SPENCER CHEMICAL CO.
Henderson, Ky.
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Natural gas
Caprolactam
Products and output:
Anhydrous ammonia—79,000 ton/yr.
Nitric acid
Ammoniating solutions
Aqua ammonia
Nylon-6 resins
Personnel: R. D. Wallace, mgr.; G. Frey, supt.
Remarks: Adding plant to make nylon molding resin. Contr., Quaker; completion summer 1957.

SPENCER CHEMICAL CO.
Vicksburg, Miss.
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—70,000 ton/yr.
Ammoniating solutions
Nitric acid—36,500 ton/yr.
Urea solutions
Personnel: W. A. Johnston, mgr.; J. A. Straub, supt.

SPENCER CHEMICAL CO.
Fort Worth, Texas
Products and output:
Liquid carbon dioxide
Dry ice
Personnel: R. R. Stevens, mgr.

SPENCER CHEMICAL CO.
Orange, Texas
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Polyethylene—45 million lb./yr.
Personnel: E. L. Stevens, mgr.
Remarks: Plan to double capacities for conventional and medium density polyethylene by 1958. Engineering by company's engrg. staff; prime contractor, Quaker Valley Contracts, Inc., Spencer subsid.

STANDARD OIL CO. OF CALIFORNIA
El Segundo, Calif.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Benzene
Toluene
Paraxylene
Cumene
Butadiene-butylene mixtures
Aliphatic acids
Personnel: D. K. Harger, genl. mgr.

STANDARD OIL CO. OF CALIFORNIA
Richmond, Calif.
Hydrocarbon raw materials:
Natural gas
Petroleum base stocks
Products and output:
Paraxylenes
Orthoxylene
Industrial xylenes
Alkyl aromatic detergents
Metallic naphthenates and naphthenic acids
Cresylic acids
Petroleum sulfonates
Polybutenes
Gas odorants
Ethyl mercaptons
Phthalic anhydride
Phenol—35 million lb./yr.
Acetone—20 million lb./yr.
Isophthalic acid—50 million lb./yr.
Nitric acid—90,000 ton/yr.
Metaxylene—5 million lb./yr.
Ammonia—100,000 ton/yr.
Benzoic-toluic acids—5 million lb./yr.
Catalysts
Personnel: C. W. Rehfuss, genl. mgr.
Remarks: Paraxylene plant (own design) building, for April '58 completion, feed will be whole xylenes to produce 27 million lb./yr. paraxylene. Polybutene plant (own design) building, for July '58 completion, feed will be butenes to produce 2.5 million gal./yr. polybutenes.

STANDARD OIL CO. (INDIANA)
Wood River, Ill.
Hydrocarbon raw materials:
Heptane heart-cut or nonene
Products and output:
Isooctyl, decyl or higher alcohols—20 million lb./yr.
Polybutenes and high molecular wt., hydrocarbons
Sodium cresylate
Lube oil detergent and anti-corrosion additives
Petroleum base plasticizers
Personnel: L. H. Butterworth, mgr.; S. E. Cahoon, E. A. Jack, asst. mgrs.; J. K. Roedel, chf. engr.
Remarks: Amoco Chemicals Corp. is sales organization.

STANDARD OIL CO. (INDIANA)
Whiting, Ind.
Hydrocarbon raw materials:
Petroleum fractions
Refinery gases
Products and output:
Benzene—260,000 b./yr.

Toluene—450,000 b./yr.
Xylenes—220,000 b./yr.
Sulfur—19,250 ton/yr.
Detergent alkylate—55 million lb./yr.
Sodium cresylate
Personnel: A. F. Endres, mgr.; A. H. Hayes, C. H. Dougherty, A. S. Musselman, P. T. Oak, E. G. Whiley, N. T. Robey, asst. mgrs.; P. L. Krausel, chf. engr.
Remarks: Amoco Chemical Corp. is sales organization for these petrochemicals.

STANDARD OIL CO. (INDIANA)
Sugar Creek, Mo.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
C$_4$ olefin concentrate
Personnel: H. R. Boehmer, mgr.; J. H. Johnson, I. C. Staeuble, asst. mgrs.; G. W. Larson, chf. engr.
Remarks: Supplies raw material to Wood River OXO alcohol units.

STAUFFER CHEMICAL CO.
Le Moyne, Ala.
Hydrocarbon raw materials:
Natural gas and sulfur
Products and output:
Carbon disulfide
Personnel: Gordon Mitchell, mgr.

STAUFFER CHEMICAL CO.
Dominguez Jct., Calif.
Hydrocarbon raw materials:
Refinery gases
Acid sludge
Hydrogen sulfide
Products and output:
Sulfuric acid
Personnel: W. E. H. Knight, mgr.
Remarks: Building H_2SO_4 plant, for September, 1957, completion.

STAUFFER CHEMICAL CO.
Hammond, Ind.
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Refinery acid sludge
Products and output:
Sulfuric acid
Personnel: Geo. Schiffbauer, mgr.

STAUFFER CHEMICAL CO.
Louisville, Ky.
Approximate investment: $5,000,000
Hydrocarbon raw materials:
Propane-propylene
Natural gas
Products and output:
Carbon tetachloride
Perchlorethylene
Hydrogen chloride
Chloroform
Methylene chloride
Personnel: H. C. Kutz, plt. mgr.
Remarks: New chloroform and methylene chloride unit now operating.

STAUFFER CHEMICAL CO.
(Consolidated Chemical Div.)
Baton Rouge, La.
Hydrocarbon raw materials:
Acid sludge
Hydrogen sulfide
Products and output:
Sulfuric acid—114,000 ton/yr.
Sulfur
Personnel: W. J. Daspit, mgr.

STAUFFER CHEMICAL CO.
(Consolidated Chemical Div.)
Baytown, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Acid sludge
Products and output:
Sulfuric acid—140,000 ton/yr.
Personnel: Z. L. Evans, mgr.

STAUFFER CHEMICAL CO.
(Consolidated chemical Div.)
Houston, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Acid sludge
Products and output:
Sulfuric acid—140,000 ton/yr.
Personnel: O. D. Massey, mgr.

SUN OIL CO.
Toledo, Ohio
Hydrocarbon raw materials:
Refinery streams
Products and output:
Butylenes
Propylene tetramer (Dodecene)
Hydrogen
Personnel: J. F. Harron, mgr.; H. C. Thober, supt.; J. L. Barker, rfy. engr.

SUN OIL CO.
Marcus Hook, Pa.
Hydrocarbon raw materials:
Refinery streams
Products and output:
Benzene—19 million gal./yr.
Toluene—30 million gal./yr.
Xylene—18 million gal./yr.
Petroleum sulfonates
Naphthenic acids
Propylene tetramer (Dodecene)
Propylene trimer (Nonene)
Ammonia—109,500 ton/yr.
Sulfur—10,800 ton/yr.
Personnel: C. C. Naylor, mgr.; W. C. Huffman, supt.; F. W. Bowen, rfy. engr.

SUNTIDE REFINING CO.
Corpus Christi, Texas
Approximate investment: $10,500,000
Hydrocarbon raw materials:
Naphtha
Propylene
Products and output:
Tetramer—150,000 b./yr.
Benzene—145,000 b./yr.
Toluene—325,000 b./yr.
Xylene—400,000 b./yr.
Mineral spirits—23,000 b./yr.
Personnel: J. L. Laird, v.p. and mgr.; J. B. Hutsell, supt.; L. W. Plummer, chf. engr.
Remarks: Tetramer and mineral spirits in current production. Rexformer, Unifier and Udex units building, scheduled for completion around mid or late 1957. The investment figure is for all above units.

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TENNESSEE EASTMAN CO.
Kingsport, Tenn.
Hydrocarbon raw materials:
Natural gas or LPG
Also intermediates from Texas Eastman Co., which are in turn derived from hydrocarbon raw materials.
Products and output:
Polyethylene wax, Epolene "N"
Dinonyl phthalate
Acrylic textile fiber, Verel
Polymeric plasticizer, NP-10
Personnel: F. R. Conklin, genl. mgr.
Remarks: Commercial facilities for production of new modified acrylic textile fiber to be completed shortly. Verel is produced from intermediates supplied by outside organizations but which are derived from hydrocarbon raw materials.

TEXAS BUTADIENE & CHEMICAL CORP.
Channelview, Texas
Approximate investment: $25,000,000
Hydrocarbon raw materials:
Butanes
Isobutane
Isopentane
Products and output:
Butadiene—86,000 ton/yr.
Butylenes
Alkylate
Personnel: K. D. Bowen, mgr.; T. H. Pierson, chf. engr.
Remarks: Plant was completed Feb. 1957. Can operate for 86,000 ton/yr. butadiene or, when producing butylenes for 2.5 million b./yr. of aviation grade alkylate, butadiene production will be 65,000 ton/yr. Butadiene and butylene made by Houdry dehydrogenation; alkylate by Texaco sulfuric acid alkylation with Stratford Engrg. effluent refrigeration. Butadiene recovery is by Phillips fufural extractive distillation.

THE TEXAS CO.
Lockport, Ill.
Hydrocarbon raw materials:
Refinery gas
Products and output:
Ammonia—180 ton/d.
Aqueous ammonia
Nitric acid
Nitrogen solutions
Personnel: H. A. Lord, supt.; R. W. Sanders, supv. chem. oper.
Remarks: Under construction. Completion scheduled November, 1957.

THE TEXAS CO.
Port Arthur, Texas
Hydrocarbon raw materials
Petroleum fractions
Products and output:
Naphthenic acids
Oil layer type sulfonates
Butylenes
Propylene tetramer
Propylene trimer
Disobutylenes—8 million lb./yr.
Gasoline and furnace oil additives
Lubricating oil additives
Olefin polymers
Ethane-ethylene streams
Propane-propylene mixtures
1-butene, 2-butene mixtures
Heavy hydrocarbons
Rust inhibitors
Personnel: F. L. Wallace, mgr.; M. F. Granville, supt. of chem. oper.
Remarks: Oil additive plant completed Jan. 1957.

TEXAS EASTMAN CO.
(Div., Eastman Kodak Co.)
Longview, Texas.
Hydrocarbon raw materials:
Propane
Natural gas
Ammonia
Products and output:
Polyethylene—55 million lb./yr.
Ethyl alcohol
Butyraldehydes (normal and iso)
2-Ethyl hexanol
2-Ethyl isohexanol
Isobutyl alcohol
Isobutyronitrile
Neopentyl glycol
Nonyl alcohol
Personnel: D. C. Hull, mgr.; W. E. Saunders, supt.; W. R. Burton, chf. engr.
Remarks: Facilities to make neopentyl glycol on stream Aug. 1957.

TEXAS GAS CORP.
Winnie, Texas
Hydrocarbon raw materials:
Gas liquids condensate
Products and output:
Ethane
Isopentane
Personnel: R. T. Neville, genl. plt. supt.; R. Woolfolk, chf. engr.
Remarks: Considering manufacture of ethanol and extraction of pure cyclohexane from gas liquids condensate.

TEXAS GULF SULPHUR CO.
Worland, Wyo.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur—90,000 ton/yr.
Personnel: J. W. Estep, mgr.

TEXAS-U. S. CHEMICAL CO.
Port Neches, Texas
Approximate investment: $4,500,000★
Hydrocarbon raw materials:
Butadiene
Styrene
Naphthenic and aromatic extender oils
Products and output:
Butadiene-styrene type synthetic rubber, Syndal—127,000 long ton/yr.
Personnel: T. A. McCoy, mgr.; J. J. Koch, supt.; W. P. Kelly, chf. engr.
Remarks: ★Purchase price from U. S. Government. Owned 50-50 by The Texas Co. and U. S. Rubber Co. plant has been expanded from 88,000 long ton/yr. at time of purchase to present 127,000 long ton, and will be further expanded to 150,000 long ton/yr. by late 1958.

THERMATOMIC CARBON CO.
Sterling, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black—100,000,000 lb./yr.
Personnel: R. W. Cretney, v.p. & genl. mgr.; S. S. Gill, supt.; G. W. Temple, chf. engr.
Remarks: Since May 1, 1957, has been a division of Commercial Solvents Corp., operating as an autonomous division.

THUNDERBIRD CHEMICALS, INC.
Kyrene, Arizona
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia—40,000 ton/yr.
Urea—16,200 ton/yr.
Sulfuric acid—61,200 ton/yr.
Remarks: In planning stage. Design and construction under direction of Tellepsen Petro-Chem Constructors. Area capacity 40,000 ton/yr.

TIDEWATER OIL CO.
Delaware City, Del.
Hydrocarbon raw materials:
Sour refinery streams
Products and output:
Sulfur—350 long ton/d. (potential)

Personnel: G. C. Caine, mgr.; B. G. Jones and M. J. McDonald, asst. mgrs.; J. J. Mack, chf. engr.
Remarks: In operation since Sept. 17, 1956.

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UNION CARBIDE CHEMICALS CO.
Torrance, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Polyethylene—60 million lb./yr.
Ethylene glycol—10 million gal./yr.
Ethylene oxide
Personnel: C. N. Rucker, supt.
Remarks: Parent, Union Carbide Corp.

UNION CARBIDE CHEMICALS CO.
Whiting, Ind.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene glycol
Isopropanol
Acetic acid
Acetic anhydride
Acetone
Ethanol
Ethylene oxide
Methyl isobutyl ketone
Personnel: R. T. Bradley, supt.
Remarks: Parent, Union Carbide Corp.

UNION CARBIDE CHEMICALS CO.
Seadrift, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Ethylene glycol
Polyethylene
Ethylene oxide
Butadiene
Monoethanolamine
Diethanolamine
Triethanolamine
Personnel: R. P. Barry, Jr., supt.
Remarks: Increased ethylene capacity to 200 million lb./yr. in fall '56. Parent, Union Carbide Corp.

UNION CARBIDE CHEMICALS CO.
Texas City, Texas
Hydrocarbon raw materials:
Natural and refinery gases
Products and output:
Polyethylene—60 million lb./yr.
Ethyleneamines
Alcohols
Glycols
Acetone
Acetic acid
Acetic anhydride
Vinyl resins
Acetylene
Acetaledehyde
2-Aminoethyl ethanolamine
Butadiene
n-Butyl acetate
Diethylene triamine
Ethanol
Ethyl acetate
Ethylene dichloride
Ethylene glycol
Ethylene oxide
Isobutanol
Isopropanol
Isopropyl acetate
Methanol
Methyl acetone
Methyl isobutyl ketone
Tetraethylene pentamine
Trichlorethane
Triethylene tetramine
Vinyl acetate
Vinyl chloride
Personnel: T. A. Wilker, supt.
Remarks: Parent, Union Carbide Corp.

UNION CARBIDE CHEMICALS CO.
Institute, W. Va.
Hydrocarbon raw materials:
Natural gas
Other petroleum streams
Products and output:
Acrylonitrile
Acetaldehyde
Acetic acid
Acetic anhydride
Acetone
Acetonitrile
Acetophenone
Acrolein
n-Butyl alcohol
Butyric acid
Butyric anhydride
Diethylene glycol
Diisobutyl ketone
Ethanol
2-Ethylbutanol
2-Ethylhexanol
Ethylene glycol
Ethylene oxide
n-Hexanol
Isophorone
Isopropanol
Mesityl oxide
Methyl acetone
2-Methyl-5-ethyl pyridine
Methyl isobutyl ketone
Paraldehyde
2—Picoline
4—Picoline
Polyethylene
Polyethylene glycols
Plasticizers
Propionic anhydride
Styrene
Trimethyl nonanone-4
2-Ethyl hexanol
Personnel: C. H. Atwood, supt.
Remarks: Doubling acrylonitrile capacity by mid-1958. Parent, Union Carbide Corp.

UNION CARBIDE CHEMICALS CO
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural gas
Refinery gases
Crude oil
Other petroleum fractions
Products and output:
Acetaldehyde
Acetaldol
Acetoacetanilide
Acetoacet-o-chloranilide
Acetoacet-o-toluidide
Acetonitrile
Acetophenone
n-Acetyl ethanolomine
Amines
Butadiene
Butoxy ethoxy propanol
n-Butyl acetate
n-Butyl alcohol
n-Butyl amine
n-Butyl ether
Butyraldehyde
Butyric acid
Butyric anhydride
Crotonaldehyde
Diacetone alcohol
Dibutyl amine
Dichlorethyl ether
Dichlorisopropyl ether
Diethanolamine
Diethyl amine
Diethyl ethanolamine
Diethyl ketone
Diethyl maleate
2,2-Diethyl-1,3-propanediol
Diethyl succinate
Diethyl sulfate
Diethylene glycol
Diethylene glycol monobutyl ether
Diethylene glycol monoethyl ether acetate
Diethylene glycol monoethyl ether
Diethylene glycol dibutyl ether
Diethylene glycol diethyl ether
Diethylene glycol monomethyl ether
Di-2-ethylhexyl adipate
Di (2-ethylhexyl) amine
Di (2-ethylhexyl) maleate
Diisobutyl carbinol
Diisopropanolamine
Dioxane
Dipropylene glycol
Ethoxytriglycol
Ethyl acetate
Ethyl acetoacetate ethyl acrylate
Ethyl amine
Ethyl butyl ketone
Ethyl ether
Ethyl formate
Ethyl silicate
2-Ethyl 2-butyl-1,3-propanediol
2-Ethylbutyric acid
Ethylene carbonate
Ethylene chlorhydrin
Ethylene dichloride
Ethylene glycol
Ethylene glycol monobutyl ether
Ethylene glycol monoethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol dibutyl ether
2-Ethyl-1,3-hexanediol
2-Ethylhexoic acid
2-Ethyl-hexyl acetate
Glyoxal
2-Ethylhexyl amine
2-Ethylhexyl chloride
Glycol diacetate
Heptadecanol
n-Hexyl ether
Hexylene glycol
Hydroxethyl cellulose
Isobutanol
Isopropanol
Isopropanolamine
Isopropyl acetate
Isopropyl amine
Isopropyl ether
2-Mercaptoethanol
Methanol
Methoxy polyethylene glycols
Methoxy triglycol acetate
Methyl acetone
Methyl amyl acetate
Methyl amyl alcohol
n-Methyl diethanolamine
Methyl isobutyl ketone
Monethanolamine
Nonisopropanolamine
Morpholine
2,4-Pentadione-phenyl diethanolamine
Phenyl ethanolamine
Phenyl ethyl ethanolamine
Dioctyl phthalate
Plasticizers
Polyethylene
Polyethylene glycols
Polypropylene glycols
Propionic anhydride
Propylene chlorhydrin
Propylene diamine
Propylene dichloride
Propylene glycol
Propylene dichloride
Propylene glycol
Propylene oxide
Pyruvic aldehyde
Surface-active agents (ionics and anionics)
Tetradecanol
Thiodiglycol
Trichlorethane
Triethanolamine
Triethyl amine
Triethylene glycol
Triglycol dichloride
Triisopropanolamine
Trimethyl nonanol
Synthetic lubricants
Undecanol
Vinyl resins
Vinyl isobutyl ether
Wetting agents
Personnel: F. H. Belden, genl. supt.
Remarks: Parent, Union Carbide Corp.

UNION OIL CO. OF CALIFORNIA
Oleum, Calif.
Approximate investments: $600,000
Hydrocarbon raw materials:
Refinery gases and wastes
Products and output:
Sulfur—18,250 ton/yr.
Personnel: M. S. Thomson, mgr.

UNION OIL CO. OF CALIFORNIA
Santa Maria, Calif.
Approximate investment: $1,200,000
Hydrocarbon raw materials:
Refinery and natural gases
Products and output:
Sulfur—30,000 ton/yr. (two plants)
Personnel: R. A. McKean, supt. for two sulfur plants here.

UNION OIL CO. OF CALIFORNIA
Wilmington, Calif.
Approximate investment: $1,800,000
Hydrocarbon raw materials:
Refinery gases and wastes
Products and output:
Sulfur—14,000 ton/yr.
Ammonium sulfate—20,000 ton/yr.
Methyl and ethyl mercaptans—500,000 lb./yr.
Personnel: W. T. Jameson, mgr.

UNITED CARBON CO., INC.
Ryus, Kans.
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: Frank Hess, supt.

UNITED CARBON CO., INC.
Franklin, La.
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: M. J. Graham, supt.
Remarks: Adding four reactor production units for a cost of $750,000.

UNITED CARBON CO., INC.
Rayville, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Personnel: J. H. Mann, supt.

UNITED CARBON CO., INC.
Eunice, N. Mex.
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Personnel: L. L. Eubanks, supt.

UNITED CARBON CO., INC.
Aransas Pass, Texas
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace and channel blacks
Personnel: Frank Gathright, supt.

UNITED CARBON CO., INC.
Falfurrias, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks

UNITED CARBON CO., INC.
Shamrock, Texas
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: H. L. Teegerstrom, supt.

UNITED RUBBER AND CHEMICAL CO.
Baytown, Texas
Approximate investment: $8,838,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S rubber—44,000 ton/yr.
Personnel: Ted Lyman, mgr. and vp.
Remarks: Parent, United Carbon Co.

UNIVERSAL DETERGENTS, INC.
Long Beach, Calif.
Approximate investment: $1,200,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alkyl aryl sulfonates—4,320 ton/yr.
Aromatic solvents—12,000 b./yr.
Pitch stock—3,500 ton/yr.
Resin stock—1,000 ton/yr.
Personnel: M. Levine, mgr; F. E. Shryock, supt.

U. S. INDUSTRIAL CHEMICALS CO.
(Div., National Distillers and Chemical Corp.)
Tuscola, Ill.
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Natural gas streams
Hydrocarbon raw materials:
Anhydrous ammonia—45,000 ton/yr.
Nitrogenous fertilizers
Sulfuric acid—140,000 ton/yr.
Phosphatic fertilizer solution (wet process phosphoric acid)—30,000 tons P_2O_5/yr.
Isosebacic acid—10 million lb./yr.
Ammonium nitrate
Nitrogen solutions

U. S. RUBBER CO.
(Naugatuck Chemical Division)
Naugatuck, Conn.
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
Synthetic rubber S-type—22,000 ton/yr.
Styrene copolymer, Naugatex and Naugapol
Personnel: P. E. Rice, mgr. supt.; L. A. Doherty, plt. engr.
Remarks: Plant capacity being increased 30% in 1957.

U. S. RUBBER CO.
(Naugatuck Chemical Division)
Joliet, Ill.
Hydrocarbon raw materials:
Toluene
Products and output:
Explosives
Remarks: Information restricted by government security regulations.

U. S. RUBBER CO.
(Naugatuck Chemical Division)
Baton Rouge, La.
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Products and output:
Synthetic rubber N-type, Paracril
Styrene copolymers
Personnel: J. S. Brown, mgr.; J. M. Poynter, supt.; J. M. Reardon, chf. engr.
Remarks: Paracril capacity increased 60% since 1956. Capacity for high impact resins will be increased 50% in 1958.

U. S. RUBBER CO.
(Naugatuck Chemical Division)
Baton Rouge (Scotts Bluff), La.
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Personnel: J. S. Brown, mgr.
Remarks: Building $5 million plant on 150 acre site, to make Kralastic plastic materials. Walter Kidde Constructors Inc., doing design and engineering. Louisiana Industrial Services is constructor.

UTAH CHEMICAL CO.
Mt. Pleasant, Utah
Approximate investment: $9,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia—54,000 ton/yr.
Personnel: N. G. Morgan, Jr., pres.
Remarks: New plant, still in planning stages.

V

VELSICOL CHEMICAL CORP.
Marshall, Ill.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Benzene—1°
Toluene
Xylenes
Petroleum polymers
Petroleum resins
Insecticides
Naththalene
Rubber reclaim oils
Mixed aromatic solvents
Personnel: W. Camp, plt. mgr.; W. Keyes, prod. mgr.; A. B. Chadwick, dir. of mfg.

VICKERS PETROLEUM CO., INC.
Potwin, Kan.
Hydrocarbon raw materials:
Catalytic reformate
Products and output:
BTX aromatics—15 million gal./yr.
Personnel: T. Ben Arnold, mgr.; F. W. Macfarline, chf. engr.
Remarks: Procon, Inc., building $2 million Udex unit at refinery to recover 15 million gal./yr. BTX aromatics. Completion scheduled Jan. 1, 1958.

VISCO PRODUCTS CO.
Anaheim, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Oil treating chemicals
Personnel: E. T. Kocher, mgr.; W. L. Church, chf. engr.

VISCO PRODUCTS CO.
Sugarland, Texas.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Oil treating chemicals
Personnel: W. H. Kirkpatrick, vp.

W

WARREN PETROLEUM CORP.
Monument, N. Mex.
Approximate investment: $120,000
Hydrocarbon raw materials:
Acid gases
Products and output:
Bulk sulfur—1,200 ton/yr.
Personnel: L. A. Walker, supt.
Remarks: Parent, Gulf Oil Corp.

WARREN PETROLEUM CORP.
Conroe, Texas
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Propane
Products and output:
Formaldehyde—1,100 ton/yr.
Acetaldehyde—57 ton/yr.
Pentaerythritol—1,800 ton/yr.
Alcohols—1,370 ton/yr.
Personnel: K. A. Fisher, mgr.; Sam Summers, supt.
Remarks: Parent, Gulf Oil Corp.

WARWICK WAX CO., INC.
Chanute, Kans.
Hydrocarbon raw materials:
Crude oil sediments
Products and output:
Oxidized microcrystalline waxes
Microcrystalline waxes
Wax polymers
Personnel: G. Hatfield, mgr.
Remarks: Parent, Sun Chemical Corp.

WESTVACO CHLOR-ALKALI DIVISION
(Food Machinery & Chemical Corp.)
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon bisulfide
Personnel: N. C. Elphick, mgr.; M. E. Birmingham, supt.; J. S. Dewick, chf. engr.
Remarks: Expansion in progress.

WILSHIRE OIL CO OF CALIFORNIA
Norwalk, Calif.
Approximate investment: $175,000
Hydrocarbon raw materials:
H_2S from fuel gas
Products and output:
Sulfur—3,942 ton/yr.
Personnel: J. H. Ouding, mgr.; L. Earl, supt.; S. Lindsey, chf. engr.

WITCO CHEMICAL CO.
Lynwood, Calif.
Hydrocarbon raw materials:
Petroleum naphthenic acid
Products and output:
Metallic naphthenates

WITCO CHEMICAL CO.
Chicago, Ill.
Hydrocarbon raw materials:
Petroleum naphthenic acid
Petroleum wax
Asphalt fractions
Products and output:
Metallic naphthenates
Sun checking inhibitors, Sunolite waxes
Rubber extenders
Saturating compounds
Insulating mastics
Personnel: L. Wood, mgr.

WITCO CHEMICAL CO.
Lawrenceville, Ill.
Hydrocarbon raw materials:
Solid petroleum tar
Heavy liquid and semi-solid petroleum fractions
Products and output:
Rubber extenders
Extending plasticizer
Rubber softeners
Personnel: F. C. Collum, supt.

WITCO CHEMICAL CO.
Perth Amboy, N. J.
Hydrocarbon raw materials:
Solid petroleum tar
Heavy-liquid semi-solid petroleum fractions
Products and output:
Rubber extenders
Extending plasticizer
Rubber softeners
Personnel: J. R. Burgess, mgr.

WYANDOTTE CHEMICALS CORP.
Geismar, La.
Approximate investment: $8,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene oxide—60 million lb./yr.
Ethylene glycol
Diethylene glycol
Personnel: W. A. Oppold, mgr.; A. C. Schubring, chf. engr.
Remarks: Using Shell Development Co. process. Engineer-contractor is Lummus Co. Company has 1,200 acres on the east side of the Mississippi River about 25 miles south of Baton Rouge. Completion due late 1957.

WYANDOTTE CHEMICALS CORP.
Wyandotte, Mich.
Approximate investment: $7,000,000
Hydrocarbon raw materials:
Crude oil and fractions
Products and output:
Ethylene glycol
Diethylene glycol
Ethylene dichloride
Chlorinated solvents
Alkyl aryl sulfonates
Synthetic detergents
Sodium carboxy-methyl cellulose
Polyoxalkylene compounds
Chloroethers
Personnel: B. C. Cremers, genl. mgr.; L. W. Munchmeyer, asst. genl. mgr.; A. C Schubring, chf. engr.
Remarks: Building $3 million oxide products plant to make polyethers for use in polyurethanes and the Pluornic and Tetronic nonionic surface-active agents. Completion due late 1957. Engr.-contr., company engineering dept.; constr., J. A. Utley Construction Co.

WYNN OIL CO.
Azusa, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil aids
Radiator additives
Fuel additives
Lube oil additives
Personnel: John T. Appelt, mgr.

For Effective Maintenance, Save Time by

- Checking controls before shutdown
- Inspecting and repairing equipment during shutdown
- Checking equipment on startup

How to Plan Shutdowns of Vaporizers

Step by step procedure shows how to make complete inspection of vaporizers and plan necessary repairs during scheduled outages.

J. H. BORN, JR., Service Department, Foster Wheeler Corp., New York, N. Y.*

Whatever final product your plant produces, unexpected outages of process equipment or utilities are time-consuming, disruptive and expensive. The necessary repairs are generally carried out on an around-the-clock basis and are usually completed sometime between 11:00 P.M. and 2:00A.M. After completion of the job, the equipment is turned over to the operations department and, to get some much needed rest, everyone heads for home.

The next scheduled outage is generally pushed back to a latter date because the equipment has just been returned to service. Dowtherm vaporizers, like any other piece of equipment, are kept in top notch condition by regular, efficient inspection and maintenance.

It is not expected that forced outages can be eliminated entirely. But there is much that can be done during scheduled outages to assure satisfactory operation during the next operating period. The outage can be considered to consist of three phases: operating check before the outage; equipment inspection, maintenance and cleaning during the outage; check-out of equipment after resuming operations.

Observe Controls in Operation

Before taking the vaporizer out of service for a scheduled outage there are several control items that can be checked to increase the effectiveness. Now is the time to check that liquid level controller or flame failure device that may have been questioned previously but could not be attended to.

First lets look at the low level alarm. It is a simple matter to check this control while in operation, but when the vaporizer is out of service any check is incomplete. During the check-out be prepared to take gage glass readings. The bolt heads provide a satisfactory method of gaging the level at any time.

While the vaporizer is in operation, gradually close the condensate return valve. As the rate of return decreases, the level in the vaporizer will fall. Allow the level to fall and note the level in the glass when the low level alarm sounds. The alarm will continue to sound as the level falls lower in the glass. The burner cut-off point will be reached before the level reaches the bottom of the gage glass. At this point, the burner is shut down and an additional alarm or light will be energized.

If the control does not function as intended, a thorough check of the wiring should be made during the outage. If the cut-off and alarm points are not at the proper levels, adjustments should be made to obtain the proper control points. After taking the measurements, open the condensate return valve, refill the vaporizer and note the level where the low-level alarm can be reset permitting the burners to be ignited.

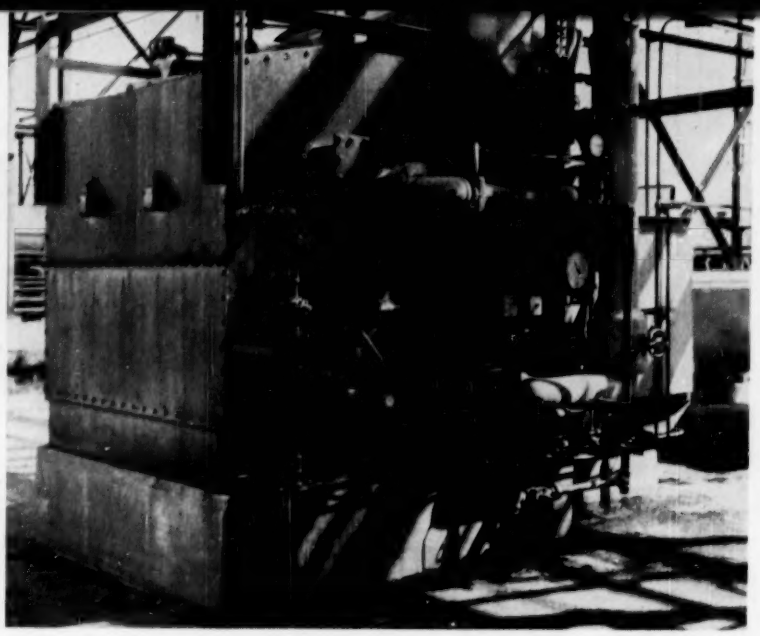
The liquid level controller, which controls the rate of return of condensate, can be checked in a similar manner. By throttling the manual condensate return valve, the position of the controlled return valve will change with level variations. The positions of the valve should be noted at various levels. On increasing level, the liquid level control valve should move towards the closed position and on a falling level, the valve should move towards the open position.

Occasionally particles of foreign material cause uneven movement of the valve, no movement at all, or if lodged on the valve seat, prevent complete closure of the valve. If there are any indications that foreign material is causing the valve to act unreliably, the valve should be dismantled and thoroughly checked during the outage. It may be necessary to adjust the liquid level controller or check the control system which operates the condensate return valve.

One of the most important items to be inspected is the burner and its controls. Several burner control arrangements are currently in use. Their methods of operation are summarized as follows:

- Manual ignition followed by either high or low firing.
- Manual ignition followed by

* Meet your author on page 349.



throttling between the high and low firing rates.

• Full automatic with throttling between high fire and off.

Variations to the above are frequently employed depending upon the type of fuel. Before checking out your burner, determine what type of system your unit has.

The rate of burner response to temperature change depends upon the particular process requirements. With a properly operating controller, the system response will be minimized so that sudden changes in the load will not cause wide fluctuations in the Dowtherm temperature.

To check the response of the system to temperature change, set the controller to a higher temperature level. The burner should immediately go to the high fire position. Depending upon the particular load on the system, the time required to level off at the new temperature can be established. A properly adjusted controller should level off at the new temperature after four or five swings above and below the set temperature.

If satisfactory response cannot be obtained, adjustments to the controller are necessary. The manufacturer's operating instructions will provide sufficient information to carry out the required adjustments. These will generally consist of aligning the proportional band and reset to give the desired response.

Once the response of the controller has been checked, observe the firing conditions at both the high and low firing rates. Depending upon the type of fuel burned, the shape and the color of the visible portion of the flame will be different. It is of utmost importance to avoid flame impingement upon the heating surfaces of the vaporizer.

Flame impingement can best be described as a condition where the flame targets directly upon the vaporizer heat transfer surface. Occasionally the flame, due to overloads or poor adjustments is deflected from the brickwork within the furance onto a portion of the heating surface. Such conditions should be avoided by readjusting the burners as required.

It is desireable to know just how much fuel is being consumed when operating at high fire and low fire conditions. If a sufficient load is available, operate the vaporizer at high fire for 5 to 15 min. during which time the fuel consumption is metered. If meters are installed, this is easy to do. But if not, other means will be required such as measuring the level change in the storage tank, using a temporary limited known supply or temporary metering instruments. To avoid variations in the fuel consumption during the test, the burner is set manually.

Carrying out this test will permit you to determine how much fuel is being burned in the vaporizer at the high firing rate. The high firing rate should be consistent with the manufacturer's rating of the vaporizer.

Before leaving the burner, check the response of the flame failure device. This can be accomplished by closing the main fuel valve and measuring the time for the burner to shut down and alarm to sound. The time interval should vary from 6 seconds when firing gas to 20 seconds for oil. For each particular type of flame failure device adjustments can be made to obtain the desired timing. Consult the manufacturer's instructions for the proper method of adjustment.

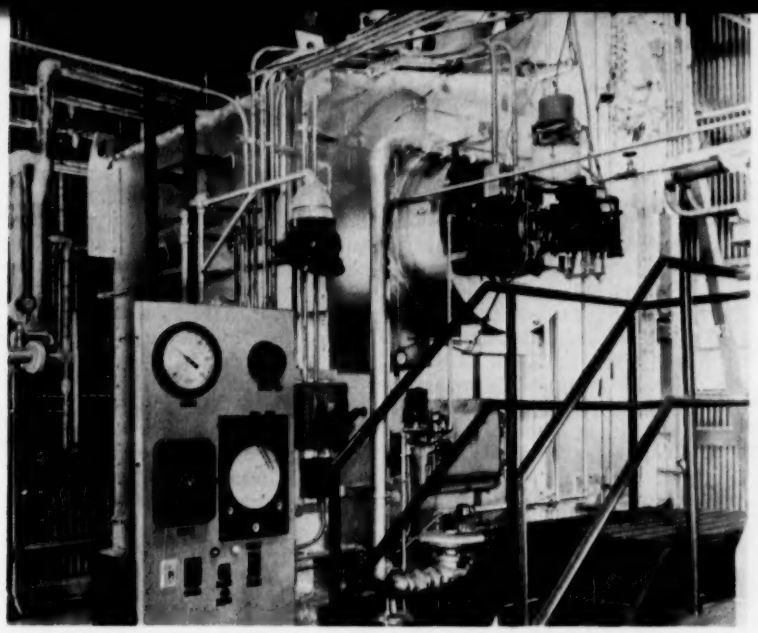
The performance of the automatic shut-off valves in the main fuel line can be easily checked by blocking off the field of vision of the scanner. This can be done in any of several ways, but must always result in a shut-down.

When gas is used for fuel, the pilot is generally continuous and is observed by the flame failure device. In this case, simply shut off the pilot and note the time until the main flame is extinguished. With fuel oils, the scanner observes the main flame. Simply by removing the scanner or by obstructing its view of the flame, the time between flame loss and shut-off can be determined. This method gives not only a check on the flame failure device, but, also provides a check on the operation of the shut-off valves.

To complete the operating check one item remains. This is the overpressure switch. To check this, one of two methods can be employed. The first method consists of increasing the vapor drum pressure until the cut-off pressure is reached. The second consists of decreasing the set point of the control until it coincides with the operating vapor pressure. When the vapor pressure and the set point of the overpressure switch coincide, the burner should be automatically shut-off for either method.

The overpressure cut-off point is usually set at 5 to 15 psi. above the maximum operating pressure anticipated. The overpressure control not only protects the vaporizer but also provides a means for protecting sensitive process material from damage due to overheating. A test of this type indicates that the control wiring and piping is satisfactory but does not indicate the accuracy of the pressure switch. To check the accuracy of the gage, a dead weight test must be applied to the gage.

All of the tests and checks out-



lined above can be carried out in a relatively short period even though it may not appear so on the first reading. When this test program is completed you will know just what controls require readjustment, new wiring or overhauling during your outage and time consuming dry-run testing is eliminated.

Shut Down Procedure

The vaporizer can now be shut down and allowed to cool. Sufficient air will enter the vaporizer through the burner air doors when they are set at the low fire position to give a safe cooling rate. Once the temperature of the vapor is below 500 F., the rate of cooling down is not vital. Too rapid a cool down may result in damage to brickwork, and hence the intial period should be controlled.

When the material in the vaporizer has cooled sufficiently, to approximately 200 F., it can be transferred to the storage tank. When this is completed, open the vaporizer for an internal inspection. Manholes, handholes and inspection ports which provide access to the internal generating surfaces should be removed. Remember that a new gasket should be used when remaking each joint; these should be on hand.

Depending upon the type of vaporizer that you have, the technique of the inspection will vary, but in any case the safety valves should be removed and tested. In examining the safety valves, check the inlet nozzle to be sure that no gummy or hard deposits have accumulated on the inlet port of the valve. If the presence of deposits is noted, the valve should be dismantled and cleaned. Care should be taken when working on the valve to follow the manufacturer's recommendations carefully. If suitable equipment is available, the valve set pressure can be checked using dry air as the fluid.

Electrically Heated Vaporizers

At least one heating element should be removed to permit an examination of the external surface. The presence of hard carbonaceous deposits indicates that other heaters should be removed for inspection. The element should be checked for signs of wear at the points of support, which may be caused by vibration or movement of the heating element.

If the soundness of the heading element is questionable, it can be checked by immersing it in water and pressurizing the electrical side with air at 5 to 10 psig. Care should be taken to keep water out of the electrical side of the element during this type of check. Any openings in the sheath can be detected by the formation of bubbles at the point of leakage. Small leaks can be repaired by carefully cleaning the area and seal welding. Check the material that the element sheath is made of before trying to braze any leaks. The material varies for some types of service.

The removal of any residual material in the drum can best be accomplished by flushing the drum with water and removing the mixture through the drain connection. It is not likely that hard carbonaceous deposits will form on the drum surface. Since this surface is not the heating surface, the residual material will settle out inside the drum.

If any hard deposits are present on the heating elements, they can be removed by scraping or brushing. The use of solvents has not been very successful in removing deposits of this kind.

To be sure instrument and gage glass connections are free and clear, blow air through these lines. This can be easily accomplished by disconnecting the drain line from the instrument or gage glass and blowing air into the drum. By manipulating the gage cocks on the gage glass, both the upper and the lower legs of the glass can be checked.

During the outage the condition of the power supply lines should be checked. The high ambient temperature in the vicinity of the connectors may cause deterioration of the insulation on the power leads. Any leakage at the heating element connections to the vessel should be eliminated.

Oil or Gas Fired Vaporizers

By far the greater majority of vaporizers in service today are either gas- or oil-fired. The condition of the burner throat and furnace brickwork is of vital importance. Cracks and fractures in the brickwork should be filled with refractory clay. The burner throat tile should be inspected and any fractures or cracks repaired; the alignment should be examined and if not concentric with the burner, remedial steps should be taken. Needless to say any residue or coke deposits must be cleared from the vicinity of the burner throat.

On occasions the burner throat may have to be replaced due to the severe duty at this area. Temporary repairs may be suitably carried out by using a plastic refractory material suitable for high temperature service. Where the design permits easy installation of a replacement throat tile, a spare should be kept on hand.

While in the furnace or in com-

bustion chamber, some additional items can be inspected. First of all the baffles installed for the distribution of the combustion gasses must be in their proper position. The manufacturer's drawings should be checked and if necessary, measurements taken to establish that the baffles are in their proper location. If these baffles are incorrectly positioned, bypassing of combustion gases will occur which will effect the heat transfer within the unit. This can result in a higher exit gas temperature than anticipated and a consequent reduction in efficiency.

A second item which can be examined is the condition of the external or gas side of the heating surface. On fire-tube type units a bore sighter may be required to permit a thorough inspection of the tube gas side surface. Any deposits on the surface should be removed preferably by mechanical methods. The use of a solution or chemical cleaning would depend upon whether the effluent could be satisfactorily drained from the system without damaging the brickwork. In some cases this may be arranged.

After inspecting the tube surface, the rolled joints should be examined. Heavy build-up of carbon deposits at the joint are indications that leakage may be occurring. Before cleaning away this material, mark the tubes that show unusual quantities of this buildup. During the pressure test, these particular joints can be carefully inspected for leakage.

For inspection purposes the pressure test is most easily applied by leaving the fluid in the vaporizer and building up to at least the operating pressure with air pressure. This not only provides the test pressure required without contaminating the system with water, but also permits the test to be carried out with a fluid that has a low viscosity.

Any leaks can be repaired by rerolling of the tube in the tube hole. Seal welding is occasionally employed. However, before welding the manufacturer should be contacted to obtain their recommendation.

If the outlet gas passes are accessible, the tubes in this vicinity should be examined for external deposits. Units that fire fuel oil and are operated intermittently are particularly susceptable to this type of condition. Such deposits restrict the gas exit area and may cause corrosion of the metal surfaces.

When this portion of the inspection is completed, the internal inspection can be started. If the unit has not been drained this should be done. When the level is below the manhole opening, the manhole may be opened and air permitted inside the vapor space. When the unit is completely drained, a lower handhole or manhole should be opened.

With the manholes open, fresh air can be circulated through the generating surface to reduce the concentration of the Dowtherm vapors. If the vapor space is accessible to personnel a fan is located outside the upper opening to blow fresh air into the area. This air will leave through the lower opening.

On liquid-tube type vaporizers, the tubes should be brushed clean with a wire brush and the surface examined. If any deterioration is detected, the tubes require replacement. In this type unit, only the tubes surrounding the furnace can be readily examined. The tubes in the convection section can only be checked by pressure test. If a vacuum is drawn on the liquid side of the vaporizer, small leaks can be detected by the sound of air being drawn into the system.

This test is suitable for both fire-tube and liquid-tube type units and permits rapid location of pinhole type leaks which are caused by corrosion due to the presence of foreign material in the Dowtherm. Any leakage detected in this fashion should be taken care of immediately by replacing the defective tube. Before evacuating the system, the vaporizer should be drained and all vents closed. Without these preliminary preparations, the test will be ineffective.

On fire-tube type units, the Dowtherm side of the tube surface should be inspected. Any accumulation of material on these surfaces must be removed. The tube sheets should be inspected and cleaned. Any sludge which may have accumulated in the lower portions of the unit should also be removed. Generally this sludge is soft and easily scraped out.

Liquid-tube units can be cleaned internally by brushing the tubes individually with a mechanical type cleaner. If the deposits are hard, a standard type tube cleaner will have to be employed. In cleaning tubes, it is important that the cleaner pass completely through the tube before being withdrawn. The lower drum acts as a collector of sludge and any sludge in this drum should be removed.

If an examination of the internal condition of the tubes is to be made, a bore sighter will be required. During tube cleaning, the material removed will also collect in the lower drum, therefore, wait until after cleaning the tubes before cleaning this lower drum.

It is important to note if any hard graphitic type carbon deposit is found adhering to the tubes internally. This indicates that low-level flame impingement or Dowtherm contamination is occurring. The tubes should be carefully checked internally and externally for possible overheated spots and the cause determined.

While the vapor space is open, check the connections to all the instruments. Be sure the lines are free of sludge by blowing through them with an air hose. Any instruments located at a distance from the vaporizer should be disconnected and the lines blown with air.

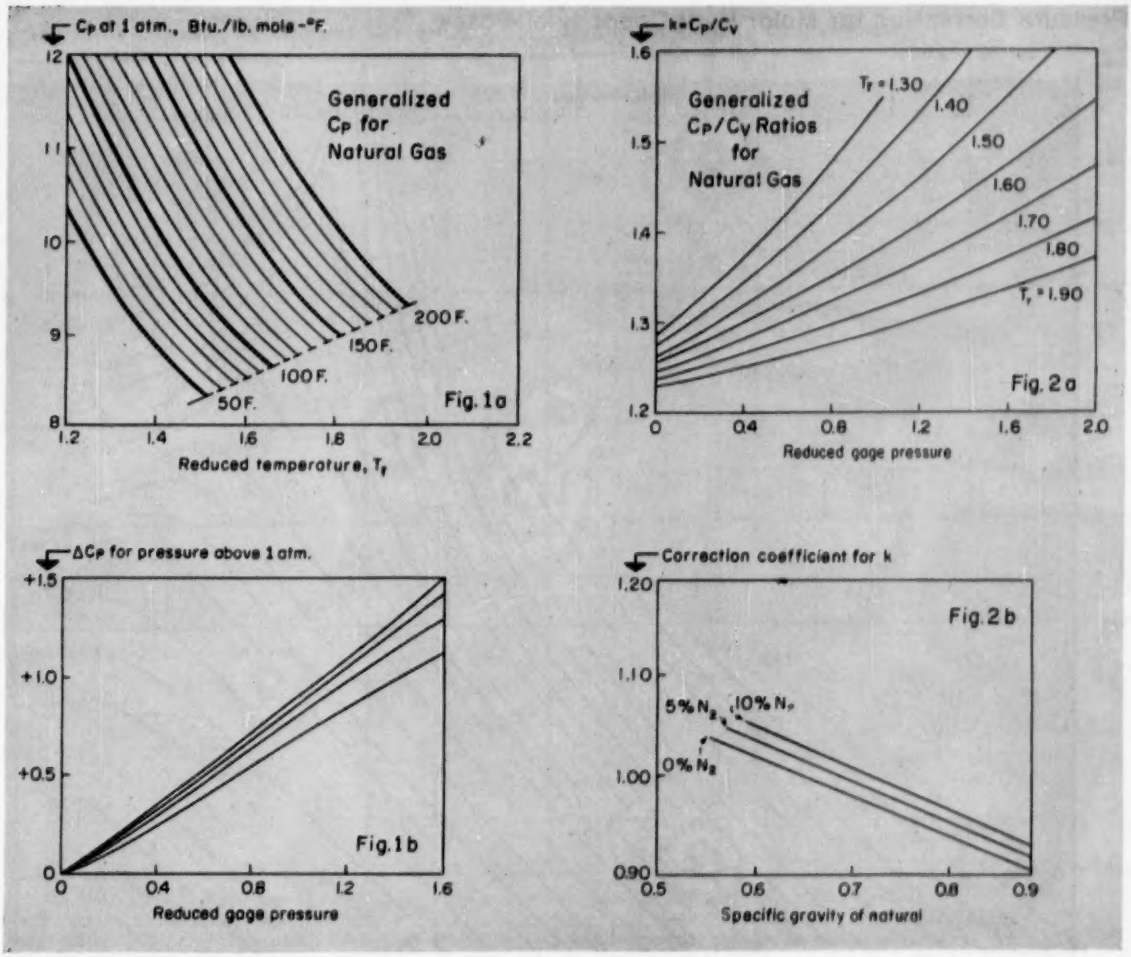
Return Vaporizer to Service

This completes the inspection of the vaporizer and its return to operation can be initiated. Be sure to use new gaskets at all flanges and manholes. A suitable gasket compound should be employed in making up the joint. The compound should be insoluble in Dowtherm and suitable for the temperature service.

After the unit is returned to service, the following points should be checked by actual tests of the controls: 1) flame failure device, 2) low level alarm and cut-off, 3) overpressure switch, 4) flame shape and characteristics, 5) temperature controller response and 6) liquid level controller.

These items should be checked in the same manner outlined for the inspection prior to shut-down.

When your vaporizer has been thoroughly inspected as outlined above, you will be in a position to schedule your next outage and make it without the in-between outage that wrecks production schedules and upsets maintenance planning.



YOU GET QUICK RESULTS FROM charts such as these for natural gas.

Generalized Gas Heat Capacities

This article—last of six—on heat capacities shows how generalized correlations can give you quick estimates for natural gas, petroleum and hydrocarbon vapors. Also, how to account for pressure dependence.

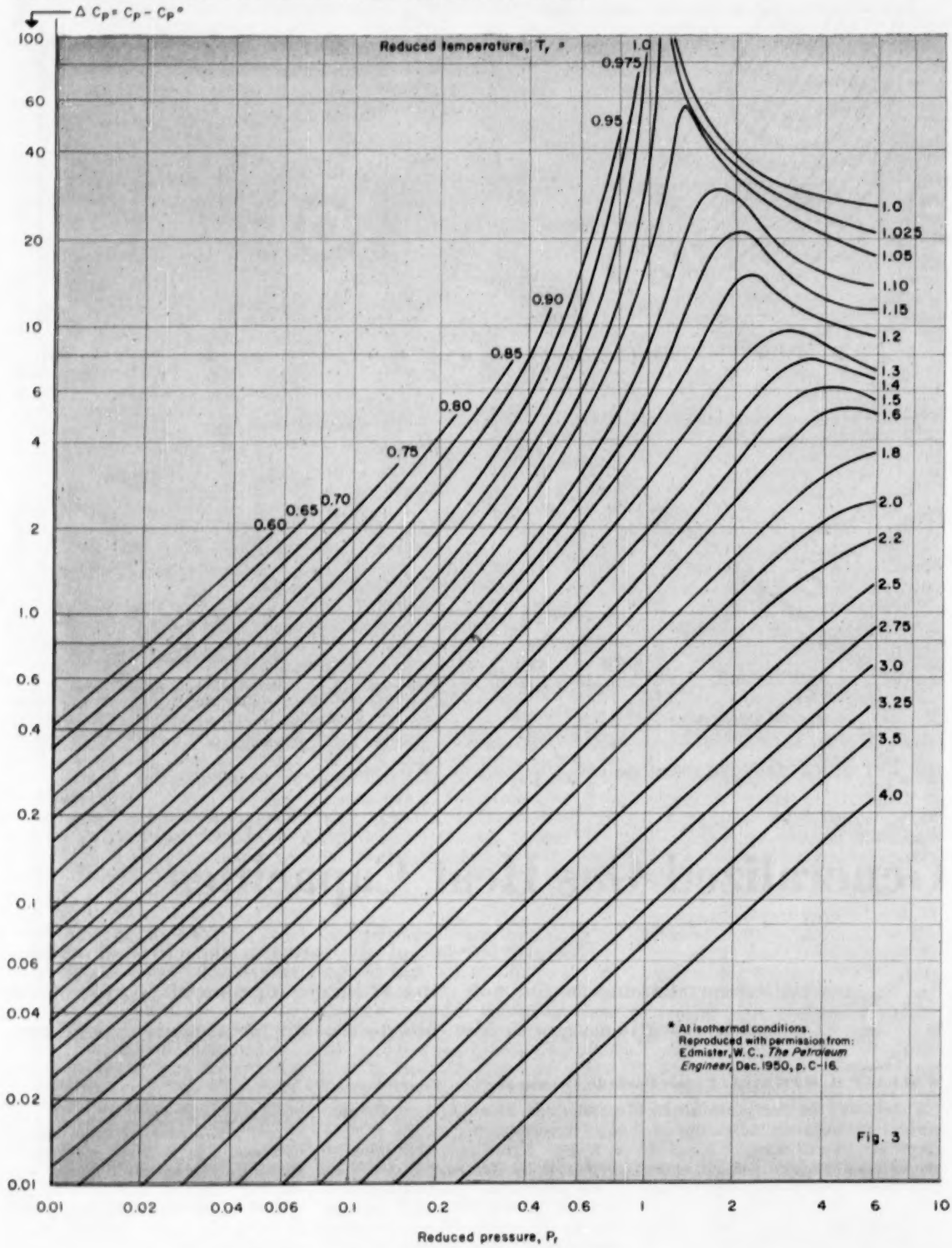
WALLACE R. GAMBILL, Union Carbide Chemicals Co., Charleston, W. Va.*

Today, and in the years ahead, natural gas acquires increasing engineering significance. Physical properties of natural gas will enter into more and more engineering calculations. Heat capacity, C_P, and heat capacity ratio, C_P/C_V, of natural gas have been conveniently correlated by Brooks.[1]

His generalized charts are shown as Figs. 1a, 1b, 2a and 2b, above. Fig. 1a gives atmospheric-pressure heat capacity as a function of temperature; and from Fig. 1b, required pressure corrections can be obtained. Fig. 2a gives uncorrected C_P/C_V ratios within 3% for gas specific gravities between 0.60 and 0.70, for gases containing up to 10% nitrogen. Outside these ranges, or for greater accuracy,

* Mr. Gambill is now with the Union Carbide Nuclear Co., Oak Ridge, Tenn. To meet your author see *Chem. Eng.*, Feb. 1957, p. 324; and Aug. 1957, p. 329.

Pressure Correction for Molar Heat Capacity of Gases *



Gas Heat Capacity Differences Derived from Equations of State*

Equation of State Used	Constants (Other than R)	$C_P - C_V$ Relation
Van der Waals: $\left(P + \frac{a}{V^2}\right)(V - b) = RT$	a, b	$C_P - C_V = R \Big/ \left[1 - \frac{2a}{RVT}\left(1 - \frac{b}{V}\right)^2\right]$ which for small values of a/RVT and b/V reduces to: $C_P - C_V = R + \frac{2a}{VT} = R + \frac{2aP}{RT^2}$
Berthelot: $P = \frac{RT}{V - b} - \frac{a}{TV^2}$	a, b	$C_P - C_V = R\left[1 + \frac{27P_r}{16T_r^3}\right]$ in reduced form, where $T_r = T/T_c$ and $P_r = P/P_c$
Callendar's simplified form: $V = b + \frac{RT}{[P - (c/T^n)]}$	b, c, n	$C_P - C_V = R\left[1 + \frac{ncP}{RT^{n+1}}\right]^2$
Keyes: $P = \frac{RT}{V - a} - \frac{A}{(V - b)^2}$ where $a = ce^{-d/V}$	A, b, c, d	$C_P - C_V = R \Big/ \left[1 - \frac{da}{V^2} - \frac{2A(V - a)^2}{RT(V - b)^3}\right]$
Beattie-Bridgeman: $P = \frac{RT(1 - e)}{V^2}(V + B) - \frac{A}{V^2}$ where, $A = A_o[1 - (a/V)]$; $B = B_o[1 - (b/V)]$; and $e = c/VT^3$	$A_o, a,$ B_o, b, c	$C_P - C_V = TX^2/Y$ where, $X = \left(V + B_o - \frac{B_o b}{V}\right)\left(R + \frac{2Rc}{VT^3}\right)$ and, $Y = 2PV^3 - (Rc/T^3)\left(V + B_o - \frac{B_o b}{V}\right) - RT\left(1 - \frac{c}{VT^3}\right)(V^2 + B_o b) + A_o a$

* Heat capacity differences given here are of molar heat capacities. These expressions were obtained by substitution of the suitable derivatives (from corresponding equations of state) into the basic relations. For dimensional consistency, the mechanical equivalent of heat, J, should be included in the denominators of the right-hand side of the $C_P - C_V$ relations when making numerical calculations.

Fig. 2b gives the specific-gravity and nitrogen-content corrections.

In calculating mixture reduced temperature, T_r, and reduced pressure, P_r, for use with these charts, it's best to use actual compositions and critical constants of the components in Kay's rule—if the required data are available. Lacking these, a good approximation to the pseudocritical temperature, T_{pc}, and pseudocritical pressure, P_{pc}, of natural gases can be made from equations proposed by Edmister.[5] Edmister's equations are based on data plots by Brown and Holcomb.[6] The plots were of T_{pc} and P_{pc} vs. gas mixture specific gravity relative to air, and they apply for a molecular-weight range of 16 to 26 and for specific gravities of 0.55 to 0.90.

Edmister's equations are given as follows:

$$T_{pc} = 190 + 283s$$
$$P_{pc} = 710 - 60s$$

where T_{pc} is in deg. R.; P_{pc} = psia.; and s is gas specific gravity (air = 1.0) and equals molecular weight/29.

What About Pressure?

The zero-pressure heat capacity, C_P^o (designated "at infinite attenuation" by some writers), does not increase much percentagewise over the 0- to 50-psia. range; and it can usually be used within this range without correction.

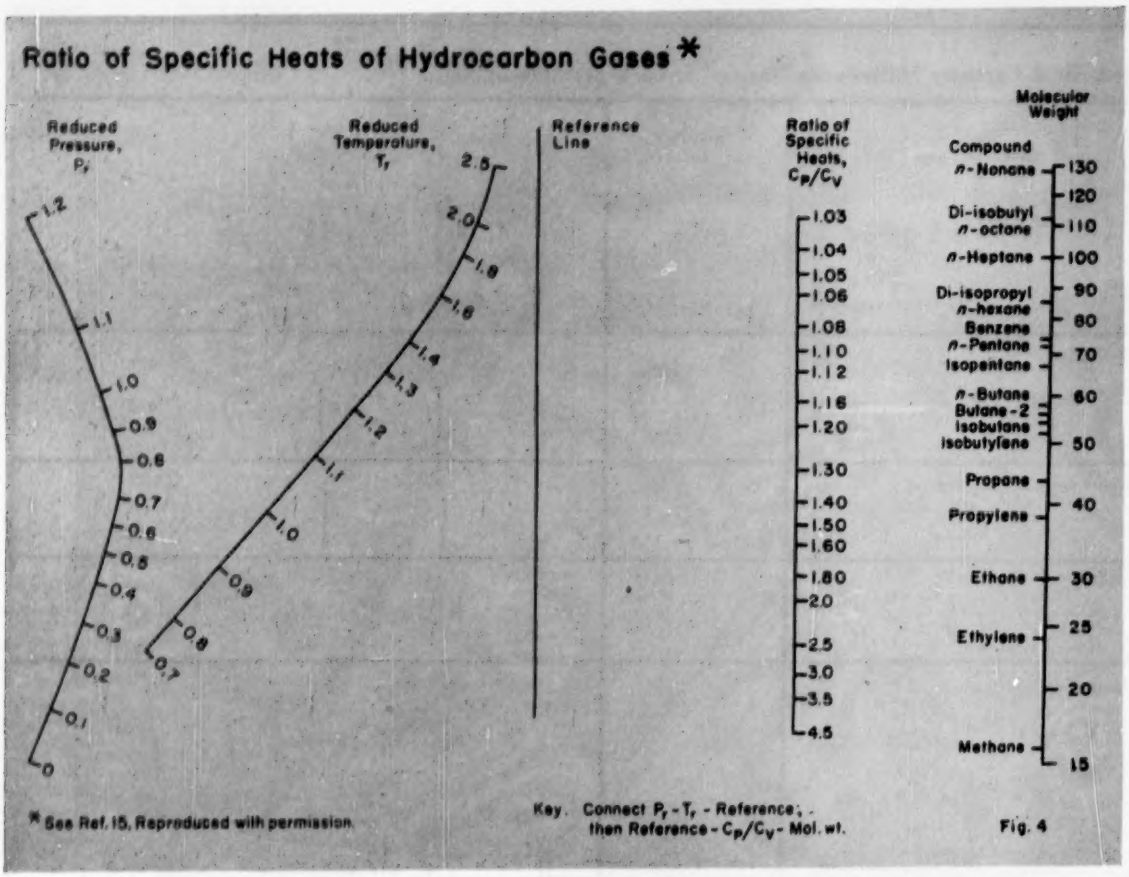
At higher densities, however, heat capacities of gases (especially C_P) vary considerably with pressure. Fairly recently, some investigators[4, 5, 6] have studied specific heats of gases at their critical points. Lee[4] computed molar values of C_V at the critical point for N_2 (11.4), CO_2 (17.4) and O_2 (13.1). These values average 150% higher than molar C_V values at 1 atm. and 0 C.

Therefore, procedures for estimating heat capacities of gases should include some ways to account for pressure dependence.

Method 1—Generalized Charts

Generalized correlation charts for the isothermal pressure correction to the heat capacities of vapors have been proposed by Dodge,[7] Watson and Smith,[8] Edmister[9] and most recently by Weiss and Joffe.[10]

These charts are plotted as a heat



capacity difference, $\Delta C_P = C_P - C_P^\circ$ (Dodge used the ratio C_P/C_P°), vs. reduced pressure, P_r, with reduced temperature, T_r, as a parameter. The first three plots are based on graphical differentiation of other generalized compressibility-factor or volume-residual charts; the last is based on an analytical differentiation of the accurate Benedict-Webb-Rubin equation of state.

Weiss and Joffe's correlation is based on data of state for five substances, and the averaged chart lines deviate from the calculated point values by 0 to 16% (4.2% avg.). Using the Weiss and Joffe procedure should give a somewhat higher degree of accuracy than by using earlier methods. But until further comparisons with experimental data are made, continued use of Edmister's plot (the most accurate earlier correlation) should be satisfactory.

Weiss and Joffe also recommended the Edmister correlation for T_r and P_r values beyond the limits of their own plot. The effect of an error in the calculated ΔC_P on C_P is small in any case unless $C_P - C_P^\circ$ is a large fraction of C_P°. Such a condition is met only at high densities.

We have shown Edmister's plot as Fig. 3, and

$$C_P = C_P^\circ - \Delta C_P$$

The error in the calculated ΔC_P (not C_P) can be as large as 30%; but it's usually much smaller.

Method 2—Equations of State

Here are four simple expressions that have been used for pressure corrections and are sufficiently accurate within their stated limits:

• From the Berthelot equation of state,

$$P = \frac{R\,T}{V - b} - \frac{a}{T\,V^2}$$

and basic thermodynamics relations, the following equation can be derived:

$$(C_P)_P = C_P^\circ + 5.03(P_r/T_r^3) \qquad (a)$$

where $(C_P)_P$ and C_P° are the molar heat capacity at finite pressure and at zero pressure, respectively; P_r is reduced pressure and T_r is reduced temperature.

For convenience from 0 atm. to 1 atm., Eq. (*a*) reduces to:

$$(C_P)_{1\ atm.} = C_P^\circ + \frac{5.03}{P_c\,T_r^3} \qquad (b)$$

where P_c is the critical pressure in atm. absolute.

Eq. (*a*) is most accurate for reduced temperatures above 1.2 and when the correction $(C_P)_P - C_P^\circ$ is no more than 2 Btu./lb. mole-deg. R. In terms of pressures the most accurate range is approximately 0 to 10 atm. abs.

• An empirical equation sufficiently accurate for most purposes when the correction $(C_P)_P - C_P^\circ$ is less than 2.5 Btu./lb. mole-deg. R., and when reduced temperature is less than 1.2 is:[11]

$$(C_P)_P = C_P^\circ + 9(P_r/T_r^3) \qquad (c)$$

• From the van der Waal's

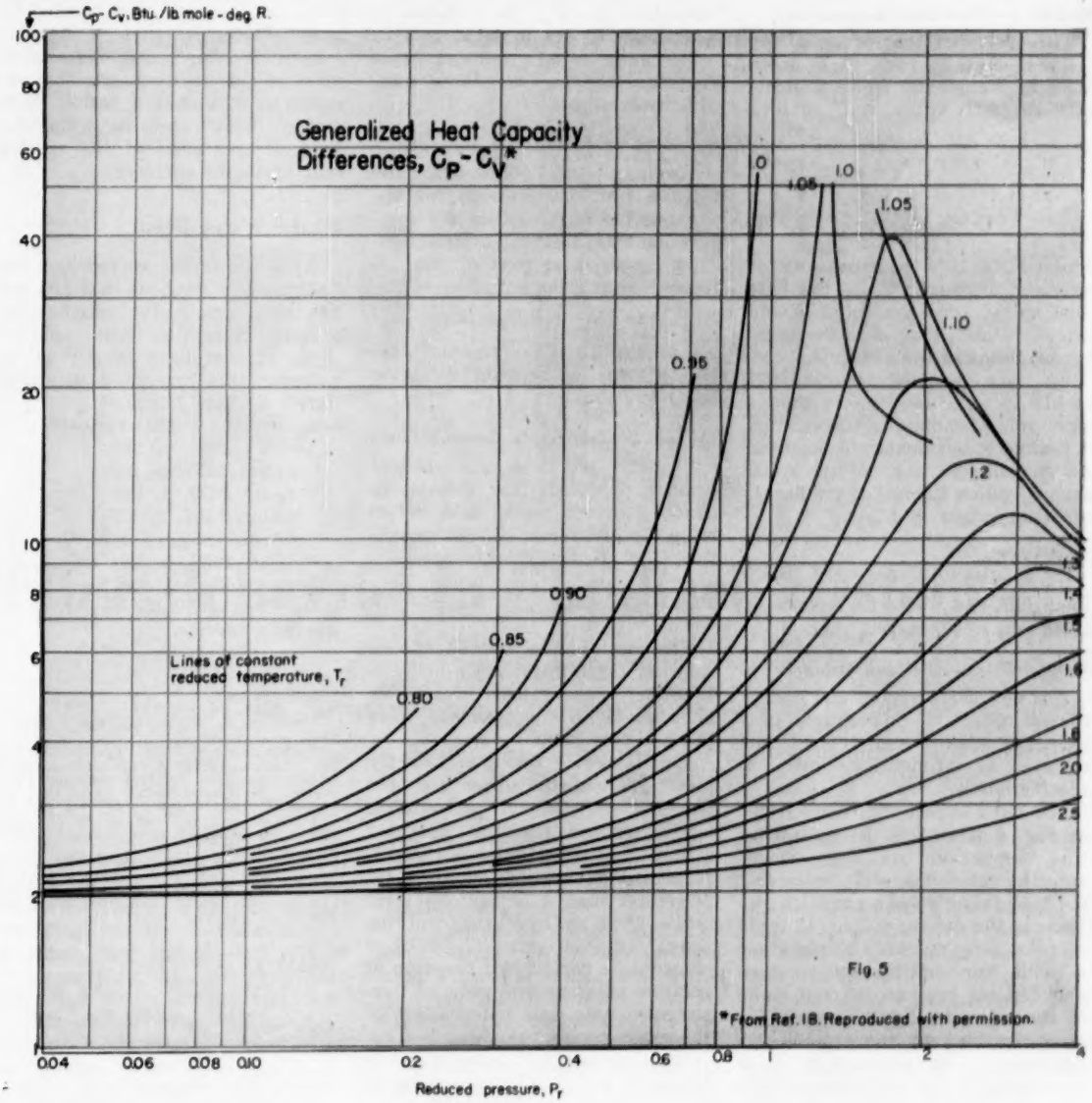


Fig. 5

equation of state we can obtain,

$$\left(P + \frac{a}{V^2}\right)(V - b) = R\,T \qquad (d)$$

$$(C_P)_P - C_P^\circ = \frac{a\,P}{R\,T^3}\left(2 - \frac{3\,b\,P}{R\,T}\right) \qquad (e)$$

the correction ΔC_P.

Eqs. (*a*) and (*c*) above are preferable to Eq. (*e*).

• An interesting relation for the effect of pressure on C_v, the molar heat capacity at constant volume, was derived and used by Ellenwood, Kulik and Gray.[12] From the Beattie-Bridgeman equation of state (see the table on p. 285), the ΔC_V equation is:

$$(C_V)_P - C_V^\circ = \frac{6\,c\,R}{J\,T^3}\left[\frac{1}{V} + \frac{B_o}{2\,V^2} - \frac{B_o\,b}{3\,V^3}\right] \qquad (f)$$

where J is the mechanical equivalent of heat.

In Eq. (*f*) the second and third terms inside the brackets are usually quite small, so that:

$$(C_V)_P - C_V^\circ \text{ approximates } \frac{6cR}{778\,V\,T^3} \qquad (g)$$

where c and R are constants of the Beattie-Bridgeman equation of state.

For absolute temperatures above 1,000 R., $(C_V)_P - C_V^\circ$ is usually small enough to be neglected in engineering calculations.

Ratios and Differences

Various methods have been proposed for estimating the ratio of heat capacity at constant pressure to the heat capacity at constant volume. Also, methods have been suggested for determining the difference between these two.

Here are some of the best of these methods.

Method 1—Naumann, Kolossowski

Two early relations proposed for the heat capacity ratio C_P/C_V were those of Naumann[13] and Kolossowski,[14] respectively:

$$C_P/C_V = \frac{5+n}{3+n} \qquad (a)$$

$$C_P/C_V = \frac{2n+3}{2n+1} \qquad (b)$$

where C_P is the heat capacity at constant pressure; C_V is the heat capacity at constant volume; and where, in each case, n is the number of atoms in the molecule.

Eq. (b) is more accurate but should be used as no more than a mere rule-of-thumb. Each relation is limited to low-density conditions. As an example, for methyl cyclohexane, which has one of the lowest reported values of C_P/C_V,

$C_P/C_V = 1.068$
(at 101 C. and 1 atm. abs.)

Eqs. (a) and (b) give values of 1.083 and 1.047, respectively.

Method 2—Scheibel and Othmer

For petroleum vapors and hydrocarbon gases a nomograph prepared by Scheibel and Othmer[15] can be used to estimate the ratio of specific heats.

We have shown this nomograph as Fig. 4 on p. 286. In redrawing this nomograph we have shown only the ratio of specific heats and the molecular weight scales to the right of the reference line. In their original, Scheibel and Othmer show a scale for critical temperature and critical pressure to the right of the reference line. These scales were provided by the authors for convenience in estimating these constants. In our redrawing of this nomograph we have eliminated this scale since a forthcoming section of this series of articles will be devoted to methods that can be used to estimate critical constants.

The nomograph (and the molecular-weight scale) was developed for the normal paraffin hydrocarbons, and hence the position of the olefin, etc., hydrocarbons on the extreme right scale is empirical and does not correspond to their actual molecular weights.

Method 3—Edmister

Edmister also correlated the specific heat ratios of hydrocarbon vapors only, proposing a graph of C_P/C_V vs. T_r and P_r for various "compound lines" from methane to n-octane.[16] Maximum error is 4%.

The chart covers reduced pressures up to 1.2 and reduced temperatures up to 2.5.

Method 4—Corrigan and Johnson

Corrigan and Johnson[17] indicated a simple expression for approximating C_P/C_V ratios for compression and expansion calculations. This appeared as part of the CE Refresher and the equation is:

$$C_P/C_V = C_P/(C_P - Rz)$$

where R is the molar gas constant; and z is the compressibility factor equal to PV/RT.

Method 5—Edmister's General Plot

Probably the most accurate and general procedure for calculating C_P/C_V, however, is to first determine the difference of heat capacities, $C_P - C_V$ and then to use:

$$C_P/C_V = \frac{C_P}{C_P - (C_P - C_V)}$$

The most handy method of calculating the difference $C_P - C_V$ is Edmister's generalized plot.[18] We have shown this plot as Fig. 5 on the previous page.

For vapors to which neither the ideal gas relationships nor the Scheibel and Othmer nomographs apply, we can use the Edmister graph. For an actual gas the difference in heat capacities, $C_P - C_V$, is greater than R (except for some gases such as hydrogen and helium). In this figure, $C_P - C_V$ is shown as a generalized function of reduced pressure and reduced temperature only and independent of the character of the vapor.

This correlation permits calculating C_V and C_P/C_V for any vapor, knowing only C_P° and ΔC_P:

$$C_V = C_P - (C_P - C_V)$$

$$C_P/C_V = \frac{C_P}{C_P - (C_P - C_V)}$$

Method 6—Equations of State

Alternatively, the relations for $C_P - C_V$ that we have listed in the table on p. 285 may be used if the constants of the appropriate equation of state are known or can be calculated for the desired range of conditions.

Special Topics

Heat capacities of paramagnetic solids at ordinary and at very low temperatures have been treated by Zemansky.[19]

Both Woolley[20] and Zemansky[21] consider the heat capacities of reacting or dissociating gases. Partington's book[22] contains a thermodynamic treatment of the specific heat of liquid surfaces.

Where We've Been

With this article we conclude our discussion of methods that you can use to estimate the engineering property known as heat capacity.

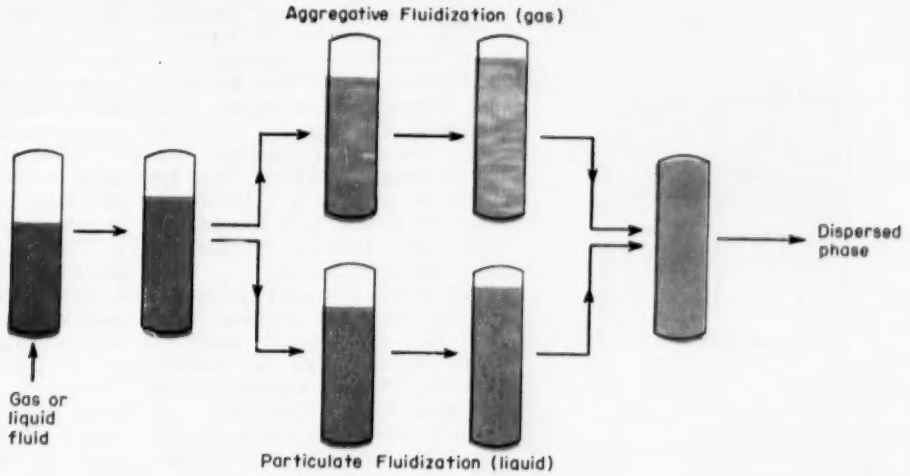
Six articles have been required to cover this important property. Here's a quick index of what has been included in this series:

- May 1957, p. 263.
- June 1957, p. 243.
- July 1957, p. 263.
- Aug. 1957, p. 257.
- Sept. 1957, p. 267.
- Oct. 1957, p. 283.

Series will continue in an early issue. For available reprints, see Reader's Service.

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Flow Behavior in Fluidized Systems

What conditions are necessary for good fluidization?

How do the particles disperse and how is uniformity of fluidization found?

How do deviations from ideal behavior influence flow relations?

MAX LEVA, Consulting Chemical Engineer, Pittsburgh, Pa.*

Fluidization describes an operation which pertains to a mode of granular solids-fluid contacting. When subjecting a column of particulate matter to an upward-directed fluid stream, the bed of solids may expand. In this state the column may, under certain conditions, exhibit properties that appear to resemble some properties of liquids.

Thus fluidized columns offer a typical head. This property has its exact counterpart in the hydrostatic head common to liquid columns. Furthermore solids in the fluidized state possess a degree of mobility that is comparable to that of liquids.

The advent of systematic applications of fluidization dates back to only a decade and a half. The new technique is nevertheless in use on an impressive scale, notably in the petroleum industry.

Other important applications are found in the mineral processing industries, in inorganic ore roasting processes, organic catalytic reactions and in unit operations.

Five of the chief advantages of the method are:

- Continuous operation. Since spent solids are easily removed from a system, continuous operation may result. The spent solids may then be reactivated or replaced by fresh solids.
- Flat temperature profiles. Intense particle and gas agitation in the bed produces flat temperature distribution, longitudinally as well as horizontally.
- High heat transfer coefficients. The particle motion past the heat transfer surfaces results in comparatively high wall to bed heat transfer.
- Relatively low pressure drops through fluidized beds.
- Savings effected in catalyst preparation since no definite shapes are required for fluidization.

Four of the chief disadvantages are as follows:

- Average solid and gas flow is largely concurrent. Thus driving forces may be adversely affected in physical operations.
- Erosive damage to reactors and transfer accessories may be severe.
- Requirement for catalyst recovery equipment because of elutriation.
- Attrition of catalyst and its replacement cost.

The following fundamental questions seem to be of major importance when considering possible applications of fluidization.

How the Series Is Organized

Random Packed Towers
- Gas-Liquid Systems
- Liquid-Liquid Systems

Stacked Towers
Reactors
- Fixed and Moving Beds

Fluidized Systems
- General Characteristics
- Numerical Calculations

* For author biography see *Chem. Eng.*, July 1957, p. 316.

Forces on Fluidized Charge

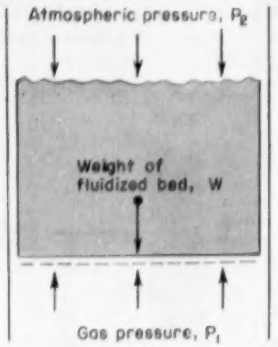


Fig. 1

1) What constitutes good fluidization?

2) How may the onset of fluidization, the expansion characteristics of a granular charge and the possible losses caused by elutriation be predicted?

Conditions for Fluidization

Characteristics of the fluidized state and the requirements for achieving it will become apparent from the following considerations. Let Fig. 1 represent a column of unit cross section. The column is charged with a granular material of uniform particle size and density and a true spherical shape.

The solids are supported on a porous disc. The top of the column is open to the atmosphere and gas is admitted from below through the disc. Assume pressure drop through the disc is negligible. Then the pressure above atmospheric of the entering gas is also a measure of the pressure drop across the column.

A state of equilibrium will prevail in the system when, for every differential strata, the weight gradient acting downward is precisely balanced by the pressure gradient of the gas acting upward. Integrated over the entire bed height, the pressure drop gradient may be expressed by the following simple equation.[4, 5, 32]

$$\Delta P_t/L = (1 - \epsilon)(\rho_s - \rho_f) \quad (1)$$

Obviously this condition will occur at a definite fluid rate, which is characteristic of the solids and fluids chosen. At this point the bed is still fixed. If the fluid rate is increased beyond this special value, the configuration of the bed must vary in such a way so as to maintain the pressure gradient constant.

It is this degree of freedom which fundamentally distinguishes the fluidized system from the fixed bed. Hence bed expansion is a necessary condition in order to render the system fluidized. But as will be observed later, it is by no means a sufficient condition.

Let us assume that the bed of solids has expanded so that its void space is now equal to ϵ_v. This condition is represented by Fig. 2*a*. As fluid rates are increased to a value G_{mf}, the pressure drop remains constant. The bed voidage (see Fig. 2*b*) will increase to the minimum fluid voidage value ϵ_{mf}.

Up to this point, the column of solids has expanded without motion being imparted to individual particles At the special voidage ϵ_{mf}, however, the particles have been disengaged sufficiently from each other to permit incipient particle movement. This is important because it signals the onset of fluidization. The value ϵ_{mf} has been termed minimum fluid voidage[4] or maximum fluid bed density.[3] It is an important concept for understanding the interrelation between particle shape and the onset of fluidization.

The quiescent quicksand bed condition[5,10] show in Fig 2*c* may be considered equivalent to the condition of a bed at, or slightly above, the voidage ϵ_{mf}. For further increases in fluid rate G_{fs}, the solids bed continues to expand and internal particle movement becomes more intense. This is the general region of so-called turbulent fluidization which is an important operating phase of the fluidized state.[5]

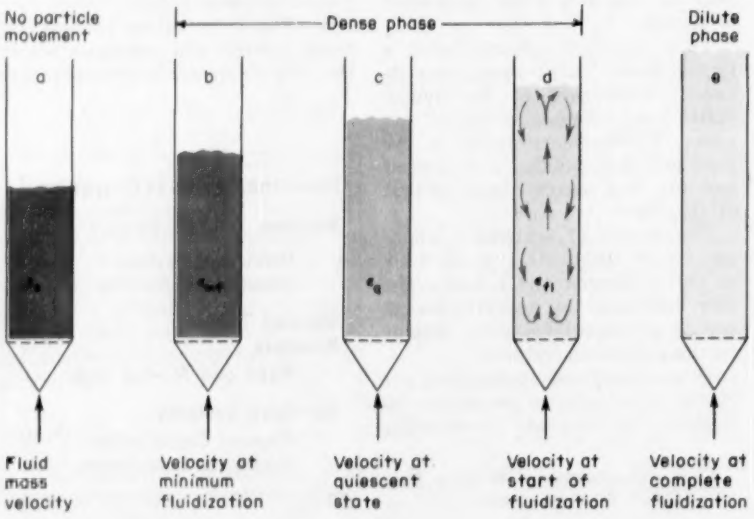
Studies of heat flow through the walls of fluidized beds indicate that heat transfer coefficients are greatly influenced by the pattern of motion and velocity of the particles. The most frequently observed solids turn-over pattern pertaining to small diameter fluidization equipment is shown in Fig. 2*d*. At the wall the particles move downward, in something like a shock wave motion, whereas in the center of the column a general ascent of solids is observed. Thus the solids seem to perform a U-turn at the base of the column.

However, there is also evidence of lateral motion further up in the bed. This is especially true in large diameter vessels. In these vessels, the coordinated vertical movement of the particles becomes greatly modified by interference of horizontal velocity components.

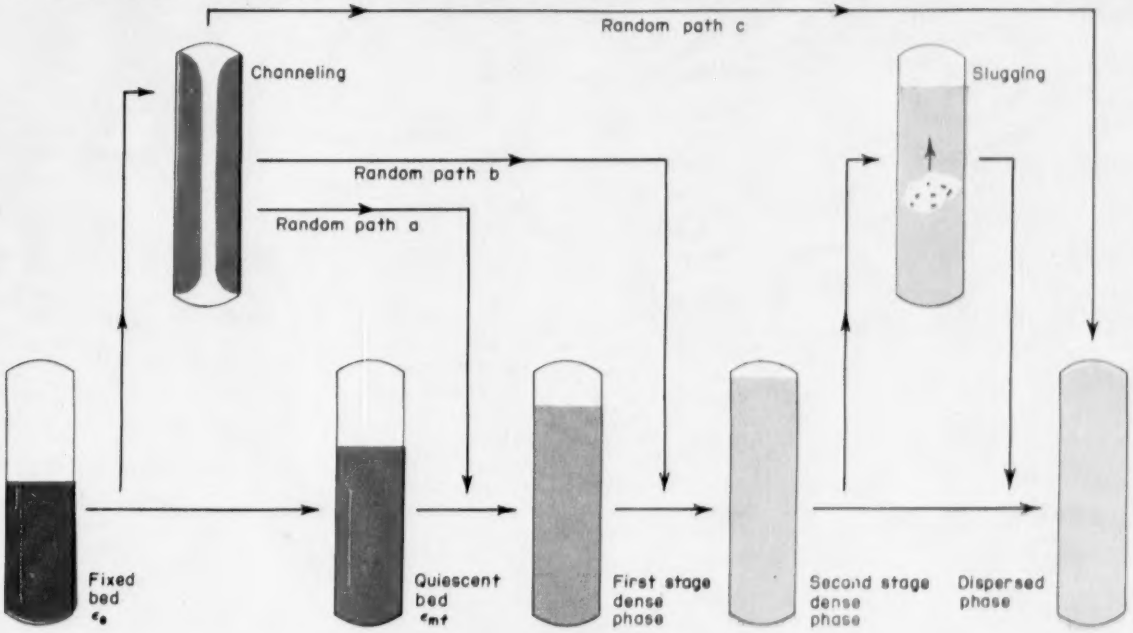
Up to flow G_{fs}, the solids have formed a so-called dense phase bed. A definite interface between the fluidized bed and the gas phase above is apparent. As the gas velocity G_{fs} approaches and surpasses[5] the terminal velocity of the individual particles, solids are carried upward in the gas stream.

Progressive Stages During Fluidization

Fig. 2



Channeling and Slugging, Common Deviations From the Ideal Fig. 3



The interface between bed and gas phase tends to disappear.

Under such conditions shown in Fig. 2*e* a new phase, the disperse fluidized phase, is formed. This is sometimes known as the dilute or lean phase. The transitions discussed have been investigated experimentally by Wilhelm and Valentine[11] as well as by Zenz.[12] So far no reliable correlation is available by which the transition from the dense to the disperse phase can be predicted.

Deviations from Ideal System

So far the discussion has been limited to what may be called an ideal system having ideal particle and fluid properties. Also the system operated without disturbances of any kind. In actual practice deviations from ideal behavior are quite common. An understanding of these abnormal phenomena and their relation to the fluidized state in general are important. These phenomena will become apparent from the following considerations.

How the Particles Disperse

Let the fixed bed of Fig. 2 have the voidage ϵ_0. By virtue of counter-gravity fluid flow, it expands through ϵ_q to ϵ_{mf}. Fluidization sets in at ϵ_{mf}. Depending on the character of the system (mainly the fluid), the resulting expanded bed will be either the aggregative or particulate type.[10] (Illus. p. 289)

Aggregative fluidization defines a condition of coexistence of the dense and dilute phase in the same column. Thus a bed fluidizing aggregatively is essentially heterogeneous. Particulate fluidization, on the other hand, refers to a state where the particles are individually and uniformly distributed in the column.

Generally speaking aggregative fluidization is usually encountered with solids-gas systems. Although cases of such systems are known that tend to fluidize more particularly than some solids-liquid systems. The latter fluidize predominately particulately, except in cases of great differences of densities between solid and liquid components.[10] The illustration shows that the dispersed suspension is reached in both cases as fluid rates are increased accordingly.

Nomenclature

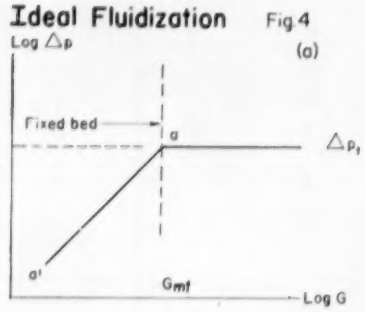
G	Fluid mass velocity
L	Bed height
P_1	Gas pressure
P_2	Atmospheric pressure
W	Weight of fluidized bed
Δp	Pressure drop
Δp_c	Pressure drop when channeling occurs
Δp_s	Pressure drop when slugging occurs
Δp_t	Theoretical pressure drop
ϵ	Bed Voidage
ρ_f	Fluid density
ρ_s	Solids density
Additional subscripts	
e	Expanded bed
f_1	Fluidized bed, dense phase
f_2	Fluidized bed, dilute phase
mf	Minimum fluidized bed
q	Quiescent bed

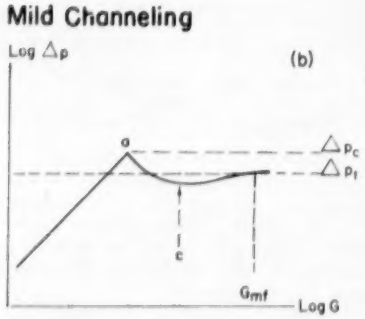
Ideal Fluidization

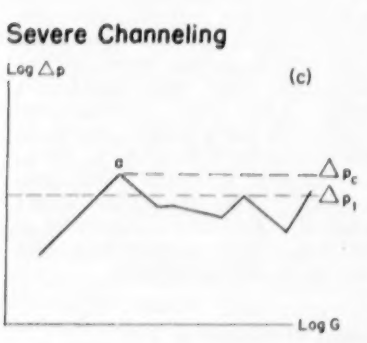
For solids which tend to fluidize almost ideally, the pressure drop-flow diagram is of the type indicated by Fig. 4*a*. Thus up to Point *a*, the bed is fixed. At Point *a*, the bed begins to expand and the pressure drop is precisely equal to the weight gradient of the bed. Another requirement of solids of this type is that the bed must be at the minimum fluid voidage.

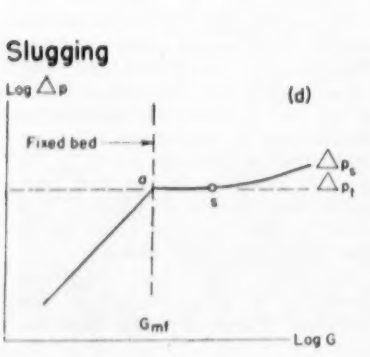
However, the ideal conditions indicated by Fig. 4*a* are seldom realized. Frequently the fixed bed

may be at a lesser voidage than ϵ_{mf}. Therefore, fluidization will not set in as a mere consequence of bed expansion. Often compacted solids of this type lead to a common irregularity, known as channeling.









Channeling in Granular Beds

The fixed bed at the voidage ϵ_c may not expand uniformly to the required voidage ϵ_{mf}. Thus it may initially fail to fluidize evenly. Instead, the fluid may select certain random paths through the bed as shown in Fig. 3. The remainder of the bed is then left relatively uncontacted.

From the non-homogeneous flow distribution over a reactor cross section, it is readily apparent that channeling is a serious disturbance. This is primarily caused by the type of solids employed. Also equipment features such as gas inlet and distributing devices and ratio of height to bed diameter may have a bearing on channeling.

Channeling phenomena are encountered in small scale as well as large scale equipment. The causes of channeling are only poorly understood. Therefore, it is apparent that severe scale-up difficulties may arise when systems with channeling tendencies are to be dealt with.

From a process development point of view, channeling is of course very objectionable. Under this condition space velocities, general contacting efficiencies and heat transfer characteristics become greatly obscured.

Furthermore in beds that display channeling, temperature profiles may become very erratic. This will obviously have an effect on catalyst activity, its life and hence the entire economics of the process.

Generally speaking channeling is more frequently met in gas-solid than in liquid-solid systems. Channeling seems to be most prevalent near the point of incipient fluidization. One way to preclude or minimize channeling is to operate the bed at as high a fluid mass velocity as is feasible. Other means of minimizing channeling pertain to specific gas distribution devices, insertion of baffles and similar equipment.

Analytically, channeling characteristics of a system are readily demonstrated by a pressure drop-flow diagram. Fig. 4*b* represents such a case. Instead of beginning to fluidize at voidage ϵ_{mf} and exhibiting essentially the theoretically calculated pressure drop Δp_t, a value Δp_c in excess of the theoretical is observed at initial bed expansion.

Thereafter pressure drop passes through a minimum point. If flow rates become high enough so as to destroy channels, normal fluidization may be induced. The paths shown in Fig. 3 indicate that the quiescent fluidization state has been by-passed.

Depending on the severity of the channeling characteristics of the solid this belated fluidization may not occur. Instead the system may pass directly into the state of the dispersed suspension as shown in Fig. 3. The pressure drop-flow diagram for this case is indicated in Fig. 4*c*.

Slugging in Granular Beds

Another frequently met disturbance is known as slugging. It defines a condition in which the gas coalesces to bubbles of the order of magnitude of the vessel diameter. By virtue of their size, the bubbles are able to push slugs of the granular solids ahead and up the vessel. On their upward passage, the solid-slugs tend to break up. Thus a dispersed suspension comes into existence.

Slugging is principally limited to small diameter equipment of considerable height. As such it will effect scale-up considerations differently than does channeling.

Since the phenomenon is not primarily caused by the solids, a bed may begin to fluidize normally. Thereafter at elevated gas rates the bed leads to slugging. This is indicated by the position which slugging occupies relative to the other fluidization phenomena as shown in Fig. 3. Obviously an increase of fluid rate beyond slugging will always lead to the dispersed phase.

Slugging tendencies may be objectionable to process development studies for several reasons. Firstly—there is an effect on effective space velocity and hence contact time. Secondly—there may result faulty indications as to heat transfer, mechanical catalysts stability, attrition and entrainment rates. The use of specially designed baffles has been found most helpful in order to preclude or minimize slugging in small pilot equipment.

Analytically, slugging characteristics of a system are also readily indicated by the pressure drop-flow diagram Fig. 4*d*. Normal fluidiza-

tion occurs initially up to the minimum fluidized bed voidage. Thereafter the pressure drop remains constant, near the theoretical value. At point *s* the pressure drop begins to rise. This increase above the theoretical value is caused by the solids-slug to wall friction.

Uniformity of Fluidization

Importance of achieving uniformity of the solids-fluid dispersion has been recognized quite early. The first attempts were to describe quality of fluidization by visual observations. These were of course too subjective and therefore not satisfactory.

The classification aggregative and particulate, derived principally from visual observation, is somewhat better. Broadly speaking it distinguishes between non-homogeneous and homogeneous conditions. Since the particulate state can be defined readily and reproduces more or less satisfactorily, there simply remains the task of analyzing the various shades of aggregation.

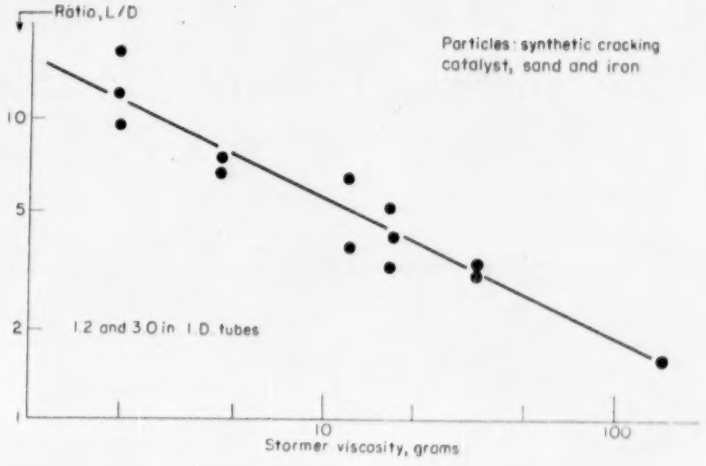
A significant advance in this respect has been made by the introduction of an electrical capacity instrument by Morse and Ballou.[7] A series of systematic capacitometer soundings disclosed that uniformity of the fluidized bed is dependent on particle size distribution, gas velocity, bed height and most likely the ratio of height to diameter of the bed. The last item is a major design feature of the reactor itself.

Dense Phase Viscosity

Fluidized solids have been compared frequently to liquids. Therefore, it is quite suggestive to attribute viscous behavior to such systems. As Matheson and coworkers[6] have pointed out, measurements with their modified Stormer viscometer do not really yield true viscosity data. The reason is that in addition to fluid shearing forces, there are undoubtedly velocity components for accelerating particles as well as interparticle frictional forces.

Nevertheless measurements with the Stormer viscometer have not been insignificant in reaching conclusions regarding the anticipated performance of fluidized systems. Among other factors it can be shown in Fig. 5 that the height to diameter ratio, known to affect slugging, will also influence the viscosity. Similarly size distribution in the charge is a definite factor.

Limiting Ratio for Slug-free Flow Fig. 5



A series of interesting tests were also reported by Kramers.[8] His tests indicate that uniformity in fluidization, as reflected by the viscosity, is a function of bed height. This corroborates the conclusions of Morse and Ballou[7] who used capacitometric measurements.

Flow properties of fluidized catalysts have been related by Dickman and Forsythe[1] to the viscosity of the bed. Generally, they found that flow properties of such catalysts were best when the viscosity increases least as deaeration proceeds. They further found that highly dense and coarse particles influence flow properties adversely.

There are many other properties of particles and beds of particles which influence flow properties and hence fluidization characteristics. We shall mention in this connection only surface characteristics, vesicularity and electrostatic forces.

Virtually no quantitative data are available on the effect of surface characteristics. Primarily particle roughness and shape, which are probably inherently related, have not yet been defined sufficiently well to be taken into account.

Vesicularity is connected with surface roughness in some minor way only. Principally it has to do with internal porosity and hence bulk density. Considerations of vesicularity become important when estimating the point of incipient fluidization.

Very little attention has been given to the nature and appearance of electrostatic forces. In fluidization studies these phenomena have been frequently cited as affecting research. Undoubtedly many data reported in the literature are affected by this difficulty. It was found especially troublesome in elutriation studies. Here much of the fine elutriated material was frequently found collected in the upper zones of the empty vessel. It is suggested that grounding of the apparatus and humidity control of the entering fluidizing gas may possibly eliminate electrostatic phenomena.

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Flow and Use Formulas for Steam

Maxey Brooke, Chemical Engineer, Old Ocean, Tex.
(For author biography see *Chem. Eng.*, July 1957, p. 318.)

32. Steam Flow Through Small Nozzles

FORMULA

$$W = Ap(16.367 - 0.96\log p)/1{,}000$$

SIMPLIFIED FORMULA

$$W = 0.0165Ap^{0.97}$$

LIMITATION

Use where atmospheric pressure is equal to or less than $0.58p$.

NOMENCLATURE

A Nozzle throat area, sq.in.
p Upstream pressure, psia.
W Flow, lb./sec.

REFERENCE

L. S. Marks, "Mechanical Engineers' Handbook," 5th. Ed., McGraw-Hill Book Co., New York.

33. Steam Flow in Pipes

FORMULA[1]

$$p = 0.04839K\left(1 + \frac{3.6}{d}\right)\frac{w^2 L}{Dd^5}$$

SIMPLIFIED FORMULA[2]

$$W = 324(PDd^5)^{0.5}$$

NOMENCLATURE

D Density of flowing steam, lb./cu.ft.
d Diameter of pipe, in.
K Constant = 0.0027
L Length of pipe, ft.
P Pressure drop per 100 ft. of pipe, psi.
p Pressure drop, psi.
W Steam flow, lb./hr.
w Steam flow, lb./min.

REFERENCES

1. Based on the Weisbach formula. "Steam," 35th. Ed., p. 318, The Babcock & Wilcox Co., (1919).
2. Based on the Gutermuth formula. "Cameron Hydraulic Data Book," 11th. Ed., p. 157.

34. Steam Use in Reciprocating Pumps

FORMULA

$$W = \frac{803G(P - p)}{SE(P_s - p_s)}$$

NOMENCLATURE

E Overall pump efficiency, %. (when not known, use 20%)
G Pump discharge, gpm.
P Pump discharge pressure, psi.
p Pump suction pressure, psi.
P_s Steam pressure, psia.
p_s Exhaust pressure, psia.
S Specific volume of steam, cu.ft./lb.
W Steam consumption, lb./hr.

REFERENCE

Oil & Gas J., Apr. 14, 1945, p. 129.

35. Steam Use in Injectors

FORMULA

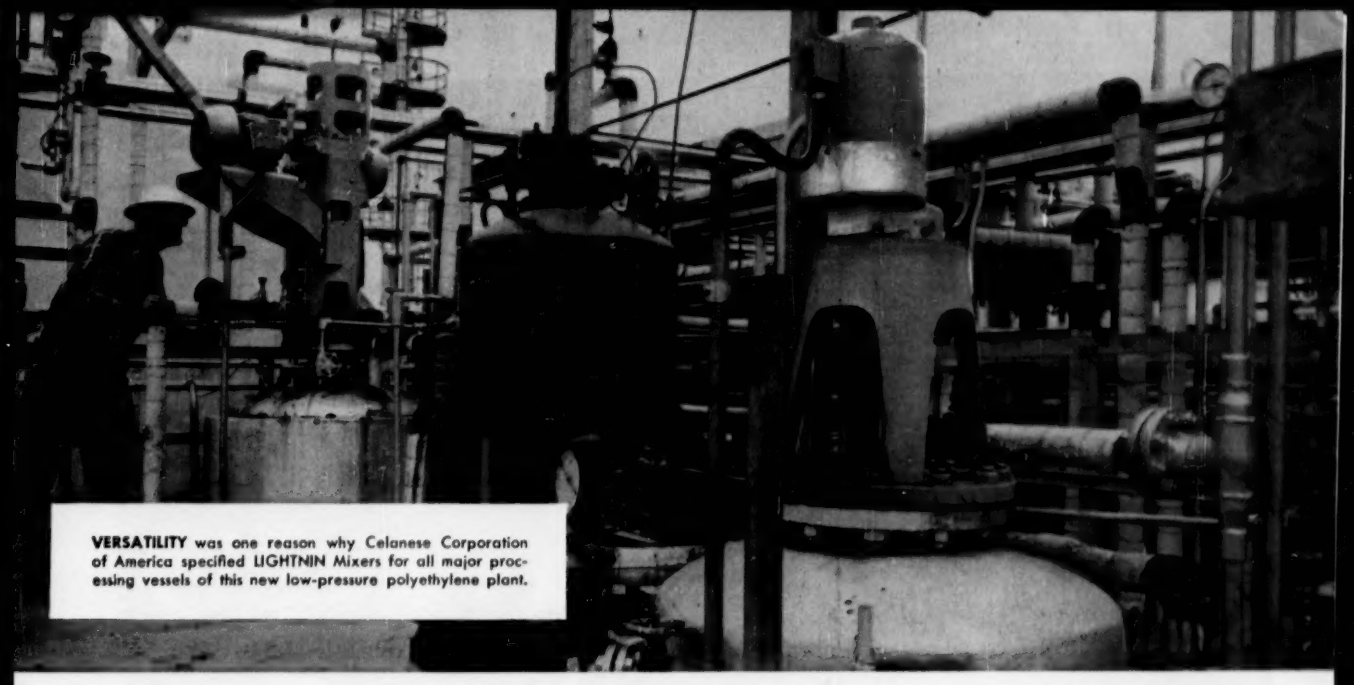
$$W/S = (H - t_1 + 32)/(t_2 - t_1)$$

NOMENCLATURE

H Heat content of steam above 32 F., Btu./lb.
S Steam consumption, lb.
t_1 Temperature of water entering injector, deg.F.
t_2 Temperature of water leaving injector, deg. F.
W Water forced into boiler, lb.

REFERENCE

Kent, "Mechanical Engineers' Handbook," 11th. Ed., pp. 60-1, John Wiley & Sons, Inc., New York.



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ANALOGIES IN PHYSICAL SYSTEMS HELP

To Develop Basic Equations

Our authors show how to derive identical mathematical expressions which result from basic equations of different physical systems.

WILLIAM E. BALL and R. CURTIS JOHNSON, Washington University, St. Louis, Mo.*

In our second installment of the mathematics refresher, we introduce some basic relationships of mechanical and electrical systems. You may well inquire as to our reasons for so doing. These are threefold—to show the identical nature of certain equations, the increased use of automatic computers and of control systems. Let us make our first point by illustration.

For a simple mechanical system, Fig. 1a, in which a mass is subjected to translation forces only

$$dv/d\theta = (1/M)\,(f_1 - f_2) \qquad (1)$$

Here v = linear velocity of object, f_1 and f_2 = applied forces, M = mass of object and θ = time.

For a mechanical system, Fig. 1b, subjected to rotational forces only

$$d\omega/d\theta = (1/I)\,(T_1 - T_2) \qquad (2)$$

Here ω = angular velocity of object, T_1 and T_2 = applied torques and I = moment of inertia.

For an inductance in an electrical system, Fig. 1c,

$$di/d\theta = (1/L)\,(e_1 - e_2) \qquad (3)$$

Here i = current, e_1 and e_2 = applied voltages and L = inductance.

For a level variation in a tank, Fig. 1d,

$$dh/d\theta = (1/A)\,(W_1 - W_2) \qquad (4)$$

Here h = height in the tank, W_1 and W_2 = flow rates in and out and A = cross sectional area.

For a simple case of heat transfer to and from a mass, Fig. 1e.

$$dT/d\theta = (1/C)\,(q_1 - q_2) \qquad (5)$$

Here T = temperature of object, q_1 and q_2 = heat flow in and out and C = total heat capacity of object.

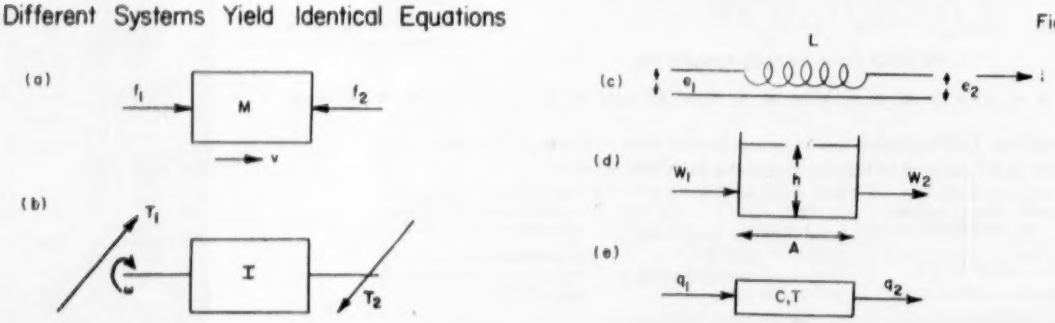
Note that all the equations are identical. In every case the change of some variable which might be defined as a measure of state of the system with time is equal to the difference between input and output divided by a capacity term. We are thus back to Eq. (1) of last month's article (*Chem. Eng.*, Sept. 1957, p. 286). Again we find it applicable to all sorts of phenomena where input minus output equals accumulation.

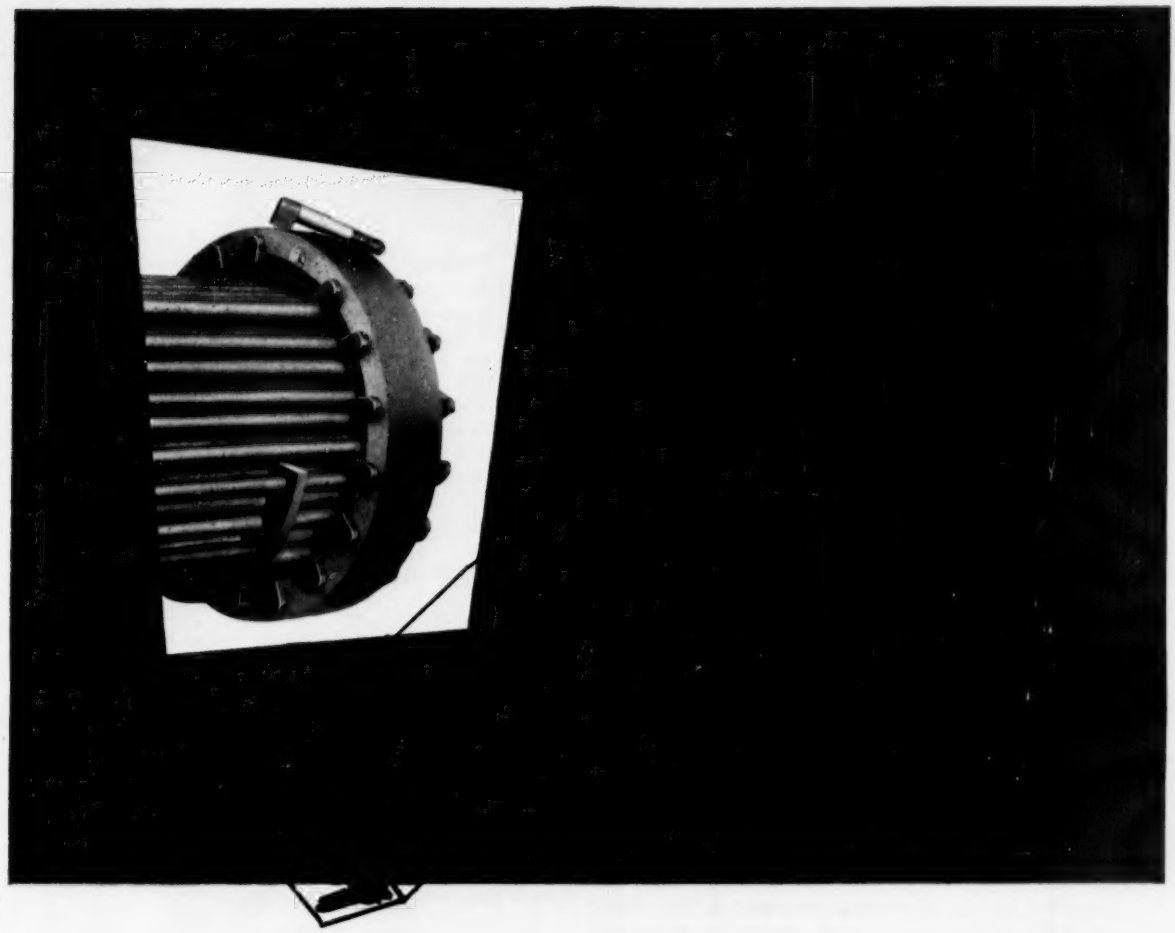
This is not to say that all these equations are easily solved. Often the input and output terms can be extremely complex; and the capacity terms can be functions of the dependent variable leading to nonlinear equations. However, we do have a simple

* For authors biographies, see *Chem. Eng.*, Sept. 1957, p. 343.

Different Systems Yield Identical Equations

Fig. 1





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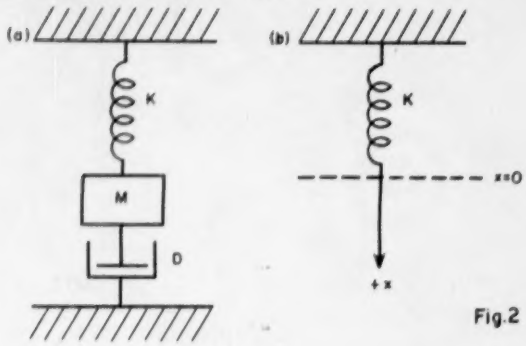


Fig.2

point at which to start our thinking in setting up a problem in mechanical, electrical or chemical systems.

Our second point should excite more interest. We have seen increasing numbers of articles devoted to the application of automatic computers. Some of these describe the uses of analog computers. In oversimplified terms, an analog computer is a dynamic simulator.

An electronic system is set up with the same equations of performance as the physical, chemical or mechanical system to be studied. Both systems obey the same relationships. Then the specific answers obtained from the analog computer are the same as those of the system we are interested in. In order to use an analog computer intelligently, we must understand to some extent the analogies between systems.

Our third reason for emphasizing the electrical and mechanical systems is that we in chemical engineering are entering an era of "automation." This also means an increased use of control systems. These systems make extensive use of combinations of electrical, electronic and mechanical parts. A complete analysis of such systems would require facility with the equations of electrical, mechanical and chemical systems.

More important, however, is the fact that much is already known of system performance. Generalized equations and charts are already available. From them such important items as system stability, speed of response and overshoot are found if certain parameters can be specified.

An understanding of this work makes it possible for us to perform useful work much more rapidly than if we derived our own basic relationships. The better our understanding of these factors, the more rapidly and effectively will we accept and use these new techniques in improved plant design and operation.

Nomenclature

a	Acceleration
B	Damping coefficient
C	Capacitance
C	Total heat capacity
D	Damping coefficient
e	Voltage
F	Force
f	Force
G	Spring Constant
g_c	Conversion factor
h	Height
i	Current
I	Moment of inertia
k	Spring constant
L	Inductance
Q	Charge
q	Heat flow
R	Resistance
T	Torque
v	Linear velocity
W	Mass
α	Angular acceleration
ϕ	Angular deflection
ω	Angular velocity

Mechanical Systems in Translation

Every day we see example after example of moving mechanical systems. All of them, from a stone we might throw to a ballistic missile, follow a few basic differential equations. For our convenience in this discussion we divide these mechanical systems into two distinct types.

The first of three basic equations, for systems moving in translation, is that represented by the action of a spring. Assuming an ideal spring, we can say that the force applied to the end of a spring to stretch or compress it is proportional to the actual deflection of the spring. In equation form this statement may be written as

$$F = kx \qquad (6)$$

where in engineering units F = force acting on the spring, lb_f.; x = deflection of the end of the spring, ft.; k = spring constant, lb_f./ft.

The second basic equation for a translational mechanical system describes the effect of a damping action. For example, how a dashpot reacts in a mechanical system. Here the applied force is proportional to the velocity of the object being damped. As before we can write this statement in equation form to get

$$F = Dv \qquad (7)$$

where $v = dx/d\theta$ = relative velocity, ft./sec. and D = damping coefficient, lb_f.-sec./ft.

The third basic equation that we will use in the following discussion is for an accelerating mass. Here we can say that the force applied is proportional to the acceleration of the object. Thus,

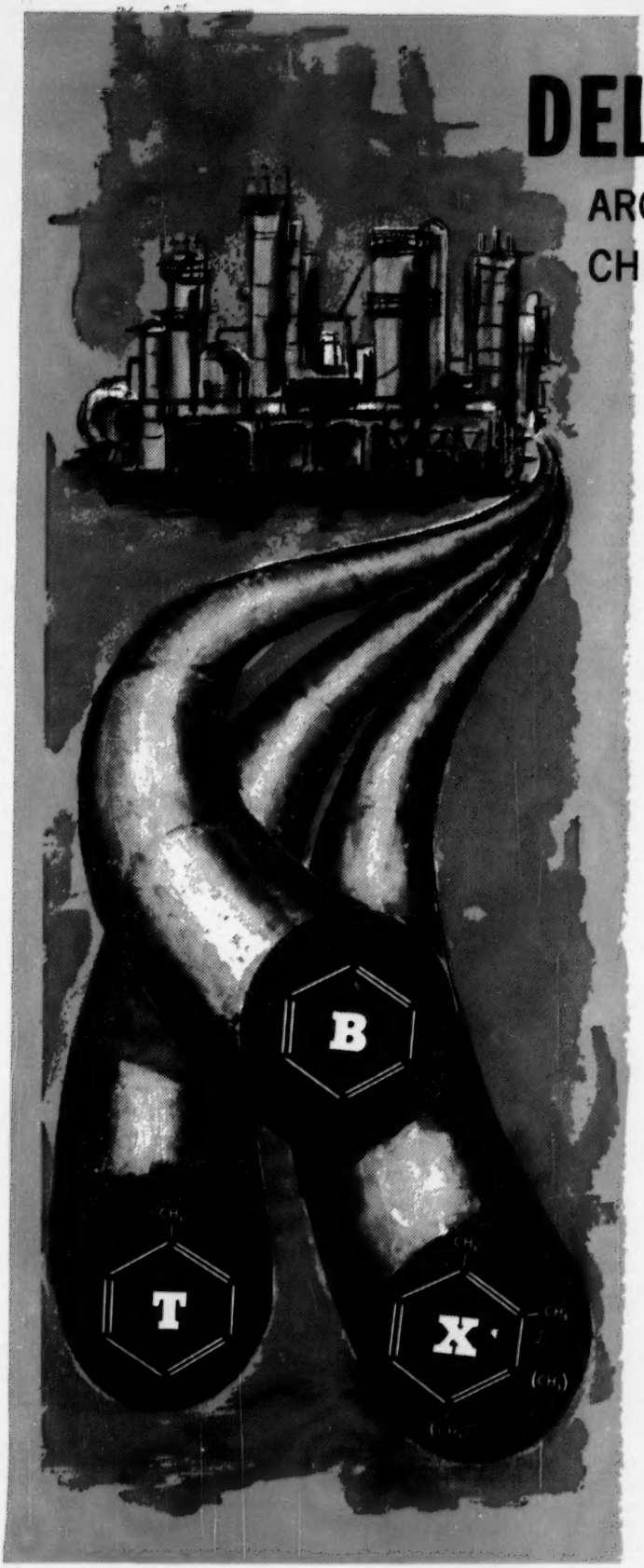
$$F = Wa \qquad (8)$$

where $a = dv/d\theta = d^2x/d\theta^2$, acceleration, ft./sec.^{2}; W = mass of object, slugs = M/g_c; M = mass, lb_m. and g_c = conversion factor, 32.2 lb_m.-ft./sec.^{2}-lb_f.

As an illustration of the use of the above equations, the following problem serves as an excellent introduction. Further on we shall consider more complex cases as we develop our analysis.

Problem 1—Derive the equation of motion for a mass suspended by a spring.

Solution—We first sketch the system as shown



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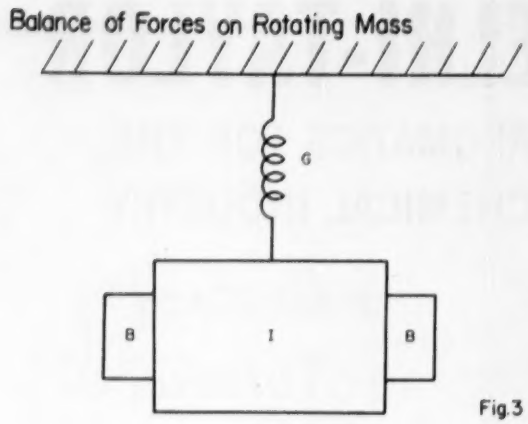


Fig. 3

in Fig. 2a. The next step is to pick a definite coordinate system. As one possibility let us choose $x = 0$ at the end of the spring when it has no force acting on it. Let x increase in the downward direction (see Fig. 2b).

We now ask the question: If the mass is now moved from its equilibrium position, what forces are acting on it?

Force of gravity:

$$F_g = M_g/g_c = Wg$$

Force resulting from the motion of the mass:

$$F_m = -Wd^2x/d\theta^2$$

Force resulting from the dashpot:

$$F_D = -Ddx/d\theta$$

Force resulting from the spring deflection:

$$F_s = -kx$$

By making a force balance around the mass, we get the equation

$$F_g + F_m + F_D + F_s = 0 \qquad (9)$$

or

$$Wg - Wd^2x/d\theta^2 - Ddx/d\theta - kx = 0$$

Hence dividing by W and rearranging terms, we get

$$d^2x/d\theta^2 + (D/W)dx/d\theta + (k/W)x = g \qquad (10)$$

An alternate method of obtaining Eq. (9) is to consider the force balance in the form $\Sigma F = Wa$. Thus $Wg - Ddx/d\theta - kx = Wd^2x/d\theta^2$.

Mechanical Systems in Rotation

The systems in the previous section moved in translation only. Obviously this omits the entire field of rotating systems. In the following, however, note the extremely close similarity between the two sets of equations defining the two types of motion. Later on we shall see how this basic similarity extends even further to other types of systems.

In a manner analogous to Eq. (6) for a translational system involving the action of a spring, we have the equation for a torsional spring. In this case we say that the torque applied to the end of a spring, to produce a given rotation, is proportional to the actual rotation of the spring.

$$T = G\phi \qquad (11)$$

where T = torque acting on the spring, lb_f-ft.; ϕ = angular deflection of the spring, radians; G = spring constant, lb_f-ft./radian.

The second basic equation for a rotating system describes the effect of rotational viscous damping. In this case the applied torque is proportional to the angular velocity of the object being damped. Again note the similarity to the analogous translation case.

$$T = B\omega \qquad (12)$$

where $\omega = d\phi/d\theta$ angular velocity, radians/sec. and B = damping coefficient, lb_f-ft.-sec./radian.

The third basic equation is for the acceleration of a rotating mass. Here the torque is proportional to the angular acceleration of the mass.

$$T = I\alpha \qquad (13)$$

where $\alpha = d\omega/d\theta = d^2\phi/d\theta^2$ = angular acceleration, radians/sec.^{2} and I = moment of inertia, lb_m-ft.$^2/g_c$.

Problem 2—Derive the equation of motion for a rotating mass connected to a torsion spring.

Solution—The system is shown in Fig. 3. Next we define the forces acting on the rotating mass as follows:

Force resulting from the rotation of the mass:

$$T_I = -Id^2\phi/d\theta^2$$

Force resulting from the damping vanes on the mass:

$$T_D = -Bd\phi/d\theta$$

Force resulting from the spring deflection:

$$T_s = -G\phi$$

Assume the angular deflection equals zero when the torsion spring is free.

Hence a force balance gives

$$T_I + T_D + T_s = 0 \qquad (14)$$

or by substituting the equivalent values in Eq. (14) yields the differential equation,

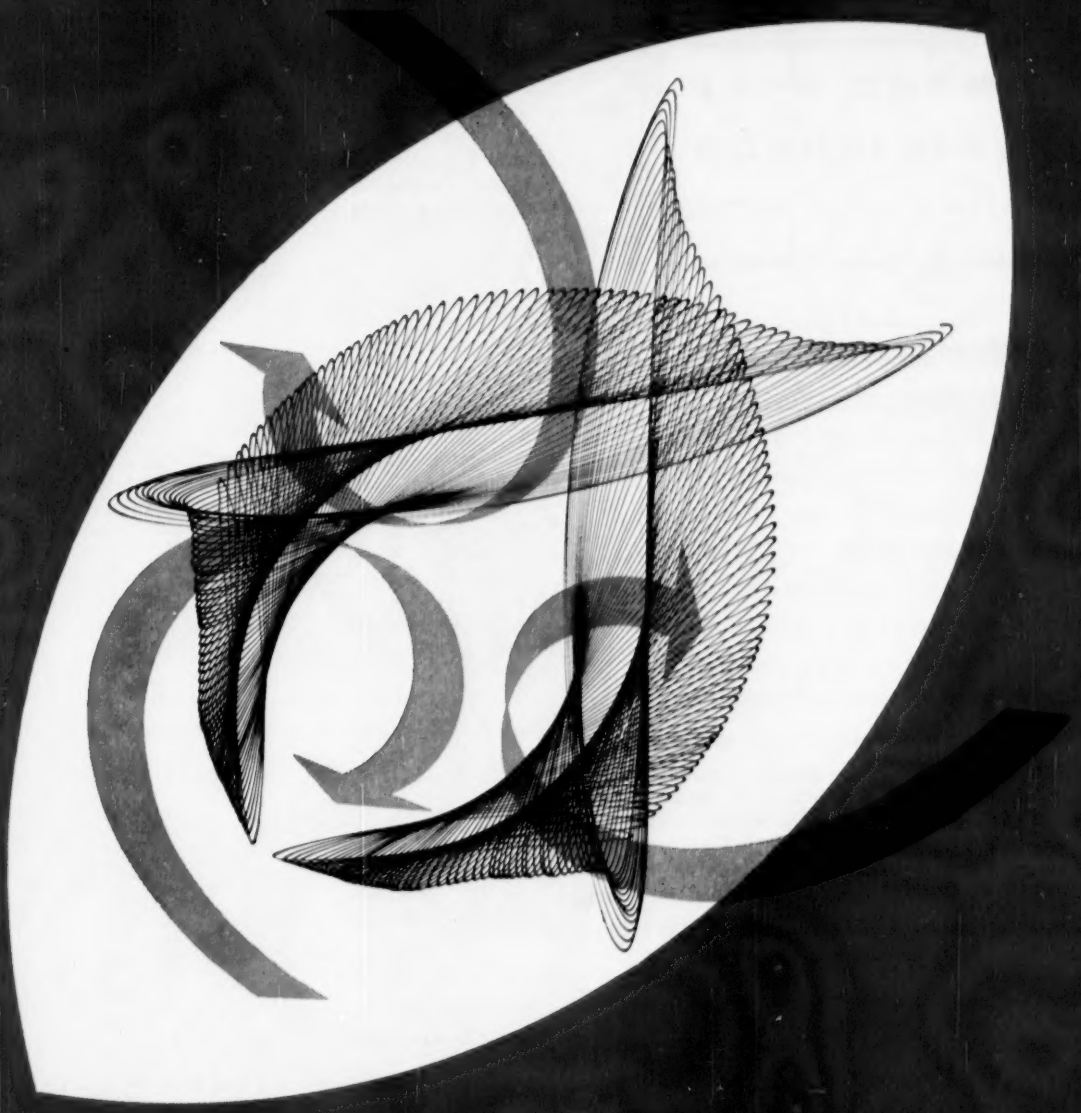
$$d^2\phi/d\theta^2 + (B/I)d\phi/d\theta + (G/I)\phi = 0 \qquad (15)$$

How Equations in Electrical Systems Compare

Many chemical engineers look back on their electrical engineering courses as an unfortunate obstacle in the path of a degree. We now take a new look at the fundamentals of electric circuits. We find some striking similarities with chemical and mechanical systems, at least from the mathematical standpoint.

One difficulty encountered in a clear understanding of electrical systems is that the units of measurements are often obscure to the man accustomed to terms such as moles, Btu. and foot-pounds. We shall mention some units along with the basic electrical equations.

In the preceding sections, we saw that translational mechanical systems and rotational mechanical systems can be separated into three basically different types of forces. We can now divide electrical systems into three systems analogous to the mechanical types.



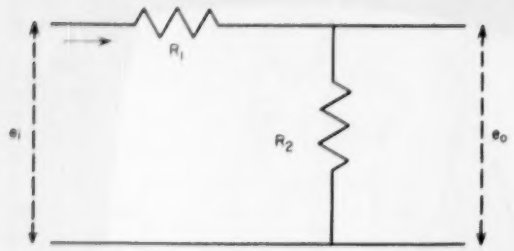
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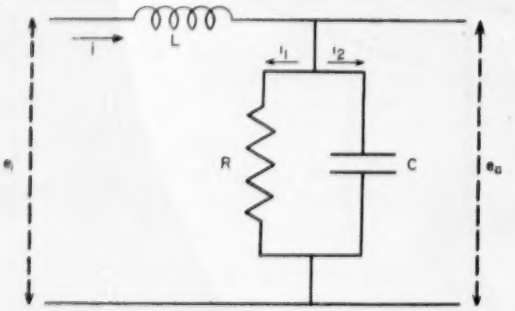
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Voltage Balance in Simple Circuit Fig 4



Voltage Balance in Reactive Circuit Fig 5



First, let us consider an inductive circuit. The voltage drop across the inductance is equal to the value of the inductance times the rate of change of the current flowing through the inductance. We can express this statement mathematically as

$$e = Ldi/d\theta \qquad (16)$$

where e = potential difference across the inductance, volts; L = inductance, henries and i = current, amperes.

Next we'll find the voltage drop across a capacitance. The voltage is equal to the time integral of the current divided by the capacitance. Mathematically, we say

$$e = (1/C)\int i d\theta \qquad (17)$$

where C = capacitance, farads.

Finally, we'll examine a circuit having resistance only. Here the voltage drop is equal to the resistance times the current flow through the resistance. The equation for Ohm's law is then stated as

$$e = Ri \qquad (18)$$

where R = resistance, ohms.

To show the similarity of these three equations to those in the preceding section, we must consider that current is the name for a derivative. Current is actually the rate of flow of electrical charge, $i = dQ/d\theta$.

By substituting $d^2Q/d\theta^2$ for the derivative $di/d\theta$ in Eq. (16), we get $e = Ld^2Q/d\theta^2$. Compare this equation with Eq. (8), $F = (M/g_c)d^2x/d\theta^2$ and Eq. (13), $T = Id^2\phi/d\theta^2$. If we had considered velocity, $v = dx/d\theta$ in the previous section, then Eq. (8) can be written $F = (M/g_c)dv/d\theta$ which corresponds exactly to Eq. (16).

In a similar manner using $i = dQ/d\theta$, we find Eq. (17) becomes $e = (1/C)Q$ which corresponds to Eq. (6), $F = kx$ and Eq. (11), $T = G\phi$. Also, Eq. (18) changes to $e = RdQ/d\theta$ which corresponds to Eq. (7), $F = Ddx/d\theta$ and Eq. (12), $T = Bd\phi/d\theta$.

The invariance of mathematical forms for completely different physical processes is remarkable. It is one reason why the modern technique of using analog computers is meeting with such huge success in analyzing many of the problems met in industry today.

Problem 3—For the circuit diagram shown in Fig. 4, how do we find the output voltage e_o for a given input voltage e_i?

Solution—Using Eq. (18), we can write $e_i = (R_1 + R_2)i$ and $e_o = R_2 i$.
Therefore:

$$e_o = [R_2/(R_1+R_2)]e_i \qquad (19)$$

This assumes no current flows out to the right.

Problem 4—As a little more advanced problem consider the circuit of Fig. 5. Again derive an equation relating the output voltage e_o for a given input voltage e_i.

Solution—The voltage drop across the inductance L is $e_i - e_o$. From Eq. (16), $e_i - e_o = Ldi/d\theta$. But i splits into i_1 and i_2, again assuming no current flow out to the right.
Therefore,

$$e_i - e_o = L[(di_1/d\theta) + (di_2/d\theta)]$$

Also, from Eq. (18) $e_o = Ri_1$ and from Eq. (17) $e_o = (1/C)\int i_2 d\theta$. We can now find the value of the current in the two branches. Hence, $i_1 = e_o/R$ and $i_2 = Cde_o/d\theta$.
Therefore:

$$e_i - e_o = L\left[\frac{di_1}{d\theta} + \frac{di_2}{d\theta}\right] = L\left[\frac{1}{R}\frac{de_o}{d\theta} + \frac{Cd^2e_o}{d\theta^2}\right]$$

Rearranging the above equation yields

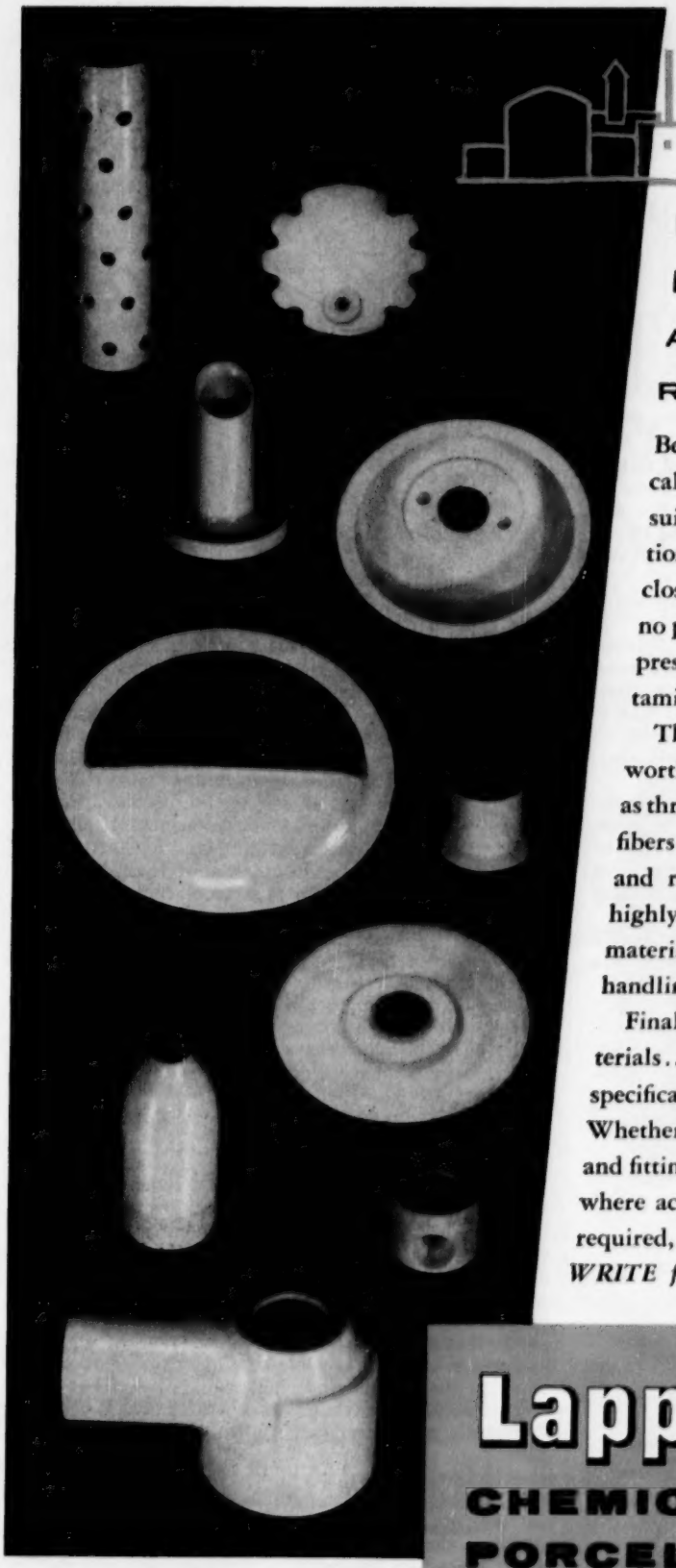
$$\frac{d^2e_o}{d\theta^2} + \frac{1}{RC}\frac{de_o}{d\theta} + \frac{1}{LC}e_o = \frac{1}{LC}e_i \qquad (20)$$

Eq. (20) has more than just a superficial resemblance to Eq. (10) and (15). By comparing the equations, it is possible to obtain corresponding values for L, C, R, e_o and e_i; and W, k, D, and x or I, G, B and ϕ.

We could then study the properties of the mechanical systems by studying the corresponding electrical system or vice versa. One possible set

Analogous Variables Help Solve Equations

Translational Mechanical System	Rotational Mechanical System	Electrical System
Linear velocity	Angular velocity	Voltage
Mass	Moment of inertia	Capacitance
Damping coeff.	Damping coeff.	Reciprocal resistance
Spring constant	Spring constant	Reciprocal inductance





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Because Lapp Chemical Porcelain is chemically inert, it is corrosion resistant and ideally suited for handling acids of all concentrations. It is pure, dense, hard, homogeneous, close-grained and non-porous so there can be no penetration—no crumbling from capillary pressures—no absorption of liquids to contaminate later processing.

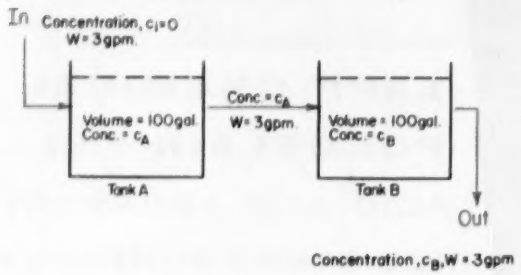
The hardness of Lapp Porcelain proves its worth when used as a "running surface" such as thread guides or rolls for processing synthetic fibers or sheet stock . . . it cannot be scratched and raise a "burr." Since Lapp Porcelain is highly abrasion resistant, it becomes an excellent material for piping to carry off fly-ash; or for handling cement, pigments and abrasive slurries.

Finally, Lapp Porcelain uses low cost raw materials . . . it can usually be fabricated to customer's specifications for considerable dollar savings. Whether it be special sleeves, nozzles, tubes, pipes and fittings, trays, plates, grates or any other parts where acid and/or abrasion resistant surfaces are required, look to Lapp Chemical Porcelain.

WRITE for description and specifications. Lapp Insulator Co., Inc., Process Equipment Div., 383 Chestnut St., Le Roy, N. Y.

Lapp
CHEMICAL PORCELAIN

Basic Material Balance in Series Fig.6



of corresponding values would be those listed in the table. Various texts give a more complete description of these types of analogous systems. For example, see W. C. Johnson, "Mathematical and Physical Principles of Engineering Analysis," McGraw-Hill Book Co., Inc., New York (1944).

Let us now consider an example of a more familiar type of system.

Problem 5—In a tank A are 100 gal. of brine containing 50 lb. of a dissolved salt. Water runs into the tank at a rate of 3 gpm. Solution from this tank runs at the same rate into a second tank B which also contains 100 gal. of solution. Similarly, solution runs from tank B at the same rate. Initially tank B contains pure water.

Derive the differential equations for the concentrations in the two tanks as a function of time.

Also make a preliminary plot of the curves of the concentrations vs. time. Show all characteristics of the curves which can be deduced from common sense.

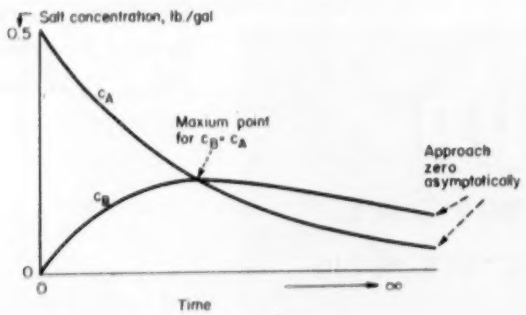
Solution—The system is shown in Fig. 6. We must first make any necessary assumptions. We assume volumes are additive and that complete instantaneous mixing occurs in each tank.

The most significant equations are the salt balances. We apply Eq. (3) from our earlier article (*Chem. Eng.*, Sept. 1957, p. 286) to each tank. Again, we find that input rate minus output rate equals accumulation rate. During the interval of time $d\theta$, the equation for

Tank A: $Wc_i d\theta - Wc_A d\theta = V_A dc_A$

Tank B: $Wc_A d\theta - Wc_B d\theta = V_B dc_B$

Use Typical Curves to Check Equation Fig.7



Rearranging and setting $V_A = V_B = V$,

$$dc_A/d\theta + (W/V)c_A = (W/V)c_i = 0$$

and

$$dc_B/d\theta + (W/V)c_B = (W/V)c_A$$

These are the equations of two first order systems in series. The output from tank A is the input to tank B.

We can also derive an equation for c_B by eliminating c_A. Differentiating the equation for c_B gives

$$d^2c_B/d\theta^2 + (W/V)dc_B/d\theta = (W/V)dc_A/d\theta$$

From the equation for $dc_A/d\theta$,

$$dc_A/d\theta = (W/V)c_i - (W/V)c_A$$

and from the equation for $dc_B/d\theta$,

$$c_A = (V/W)dc_B/d\theta + c_B$$

Substituting these expressions in the second order equation, we get

$$d^2c_B/d\theta^2 + 2(W/V)dc_B/d\theta + (W/V)^2c_B = (W/V)^2c_i$$

With $c_i = 0$, the right-hand side disappears. We now have a second order equation describing the performance of the second first-order element in series.

To establish the nature of the curves, we note the following. If the process is continued long enough, tank A should contain pure water. The most pronounced change should occur at the start. At this point the driving force or difference in concentrations between the input and tank contents is greatest. Therefore, we sketch a curve where the concentration drops from 0.5 lb./gal. to zero. The slope is greatest at the start. As the concentration decreases, the curve approaches zero asymptotically.

For tank B, we note that the first material to enter is of the initial concentration of tank A. As long as the material from A is more concentrated than that of tank B, the concentration in B rises. When the two concentrations are equal the slope of the curve for tank B should be zero.

As the concentration in A approaches zero, that of B should also approach zero asymptotically. This curve must contain a maximum and a point of inflection. The curves are shown in Fig. 7 and illustrate the change in concentration taking place in each tank.

How Similarities in Mathematics Aid Us

In the first two articles, we have touched upon some of the fundamentals of material and energy balances, heat transfer, and mechanical and electrical systems. We have shown that there are many analogies between mechanical, electrical and chemical or chemical engineering systems. A close study of the similarities of mathematical relationships shows that a solution which is valid for one of these systems may also be valid for the system encountered in chemical engineering.

This holds two advantages. The first is that very frequently a problem in chemical engineering will have been solved for a different system by a mechanical or electrical engineer. The second is that the use of analog computers means that we are setting up electrical or electronic analogies of dynamic chemical engineering systems. Therefore, it is necessary to understand these analogies to make intelligent use of analog computers.

when you count the cost of corrosion



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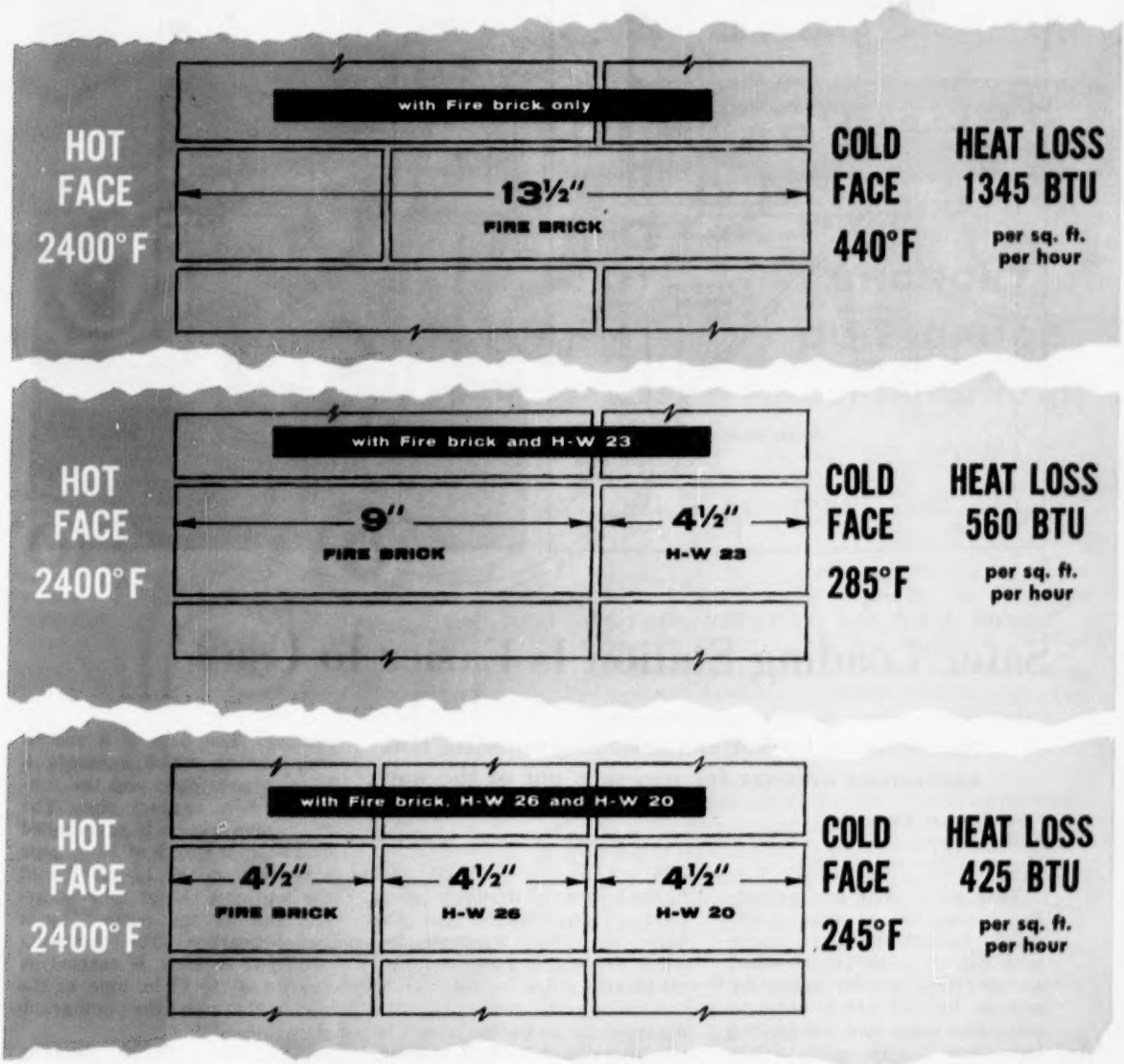
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Harbison-Walker Insulating Fire Brick



These furnace sections show how heat losses are reduced by using Harbison-Walker Insulating Brick for backing fire brick furnace walls. The heat loss is reduced 58.4% in one case and 68.4% in the other. These are typical of savings that are frequently experienced.

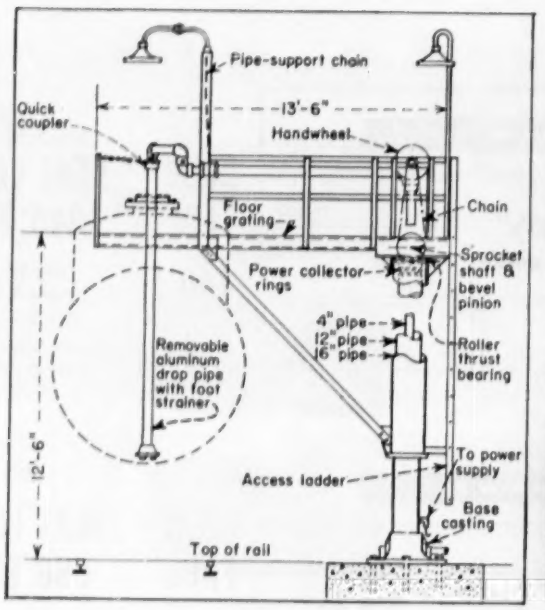
In addition to savings in fuel, floor space and weight, the use of insulating brick provides for faster heating and in some instances reduction of noise.

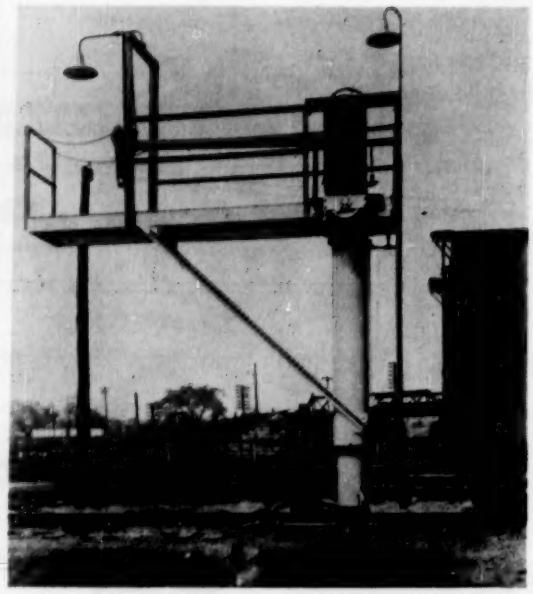
To assure best overall results, it is important that insulating refractories be carefully selected to secure the most advantageous combination of properties. Harbison-Walker having the full complement of both insulating and refractory brick, can furnish the correct combination for any requirement.

Harbison-Walker insulating brick have the balanced properties that mean dependable service. Light weight, essential to high insulating value and low heat-storage capacity, have been obtained to the greatest degree, consistent with the mechanical strength necessary for handling and for durability in service.

Harbison-Walker insulating products also include LOTHERM, the extra strength insulating fire brick; H-W Lightweight Castables; H-W Block Insulation and H-W Mineral Fiber Coatings.

Write for the H-W bulletin containing comprehensive engineering data.





Safer Loading Station Is Easier to Use

New design of loading and unloading tower for tank cars rotates over car for use, then out of the way.

* **July Contest Winner by**
Paul C. Ziemke
Engineer, Oak Ridge, Tenn.

Tank car loading and unloading operations are often somewhat hazardous, particularly with bottom unloading. We had an old style wooden unloading station for oil which gave us some bad times and we decided to replace it with an up-to-date fireproof tower which would incorporate all the latest improvements.

The old bottom emptying arrangement was simple and inexpensive, of course, but it resulted in considerable spillage. It was often embarrassing when the bottom valve proved inoperative. Sometimes the valve leaked. In the winter it was not uncommon to have the water settlings in the bottom of the tank freeze solid. Then thawing out the valve with the trackage and earth thoroughly saturated with oil became a fire hazard.

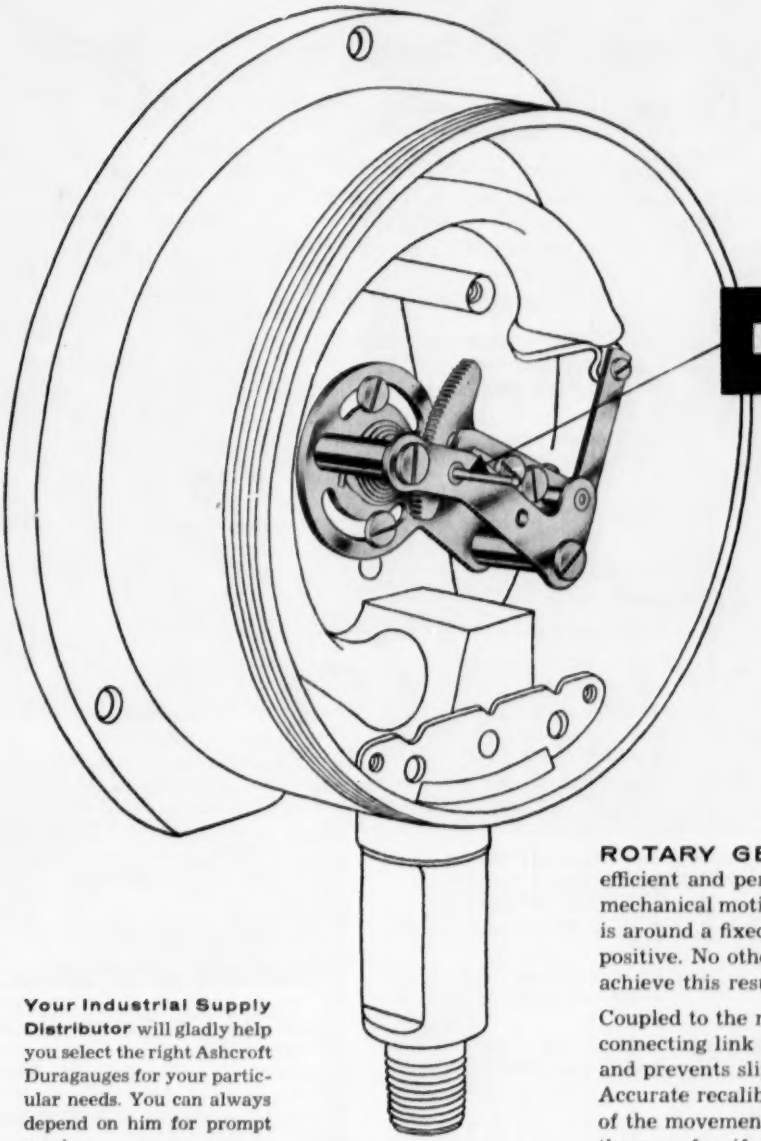
Although the new tower was designed for unloading, it can be used equally as well for loading. With proper valving arrangements it could be used for either loading or unloading. It enables the operators to reach the tank car dome with perfect safety. There is no need to climb the vertical car ladder and stand on the insecure footing about the car dome while inserting the suction pipe in the hatchway of the car.

The installation was fabricated mainly from pipe, channels, angles and some subway grating. The base is a special iron casting which supports a 12-in. pipe column and the concentric 4-in. product pipe. The 12-in. pipe column is surrounded by a shorter length of 16-in. pipe supported on the 12-in. pipe at the top by a thrust roller bearing and at the bottom by a radial bearing. The operating platform, in turn, is carried on the top of the 16-in. pipe, as the sketch above and the photograph show.

When not in use the platform is out of the way, parallel to the track. For use it is rotated manually to a position over the car. For this purpose connection is made between the outer 16-in. rotating pipe and the inner 12-in. stationary pipe column by means of a bevel gear and pinion, the latter rotated through a chain and sprockets by means of a handwheel readily accessible to the operator.

A mechanical brake attached to the turning mechanism pre-

* See page 314 for Contest rules and next month's winning article.



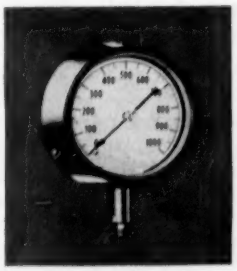
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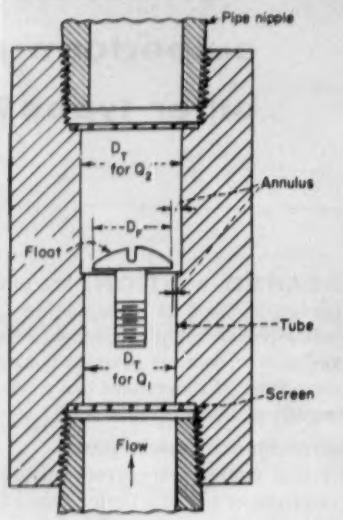
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vents movement of the platform unless the operator steps on a foot pedal while turning the handwheel.

The 4-in. internal pipe extends up through the platform and is connected by swing joints and two horizontal lengths of pipe to a quick coupler. When the station is in use the platform can be swung to accommodate cars spotted with the dome anywhere within about 3 ft.-9 in. either side of the tower centerline. A 4-in. light-weight aluminum alloy drop pipe with a foot strainer on the lower end is lowered through the dome and attached to the swing-pipe by the quick coupler.

Some of the further refinements include a supporting chain for the swing-pipe; a dust cap for protecting the pipe run when the drop pipe is not in use; brackets to hold the drop pipe on the platform when not in use; a collapsible awning for bad weather; and adequate lighting for night use. In our particular application a 3-hp. centrifugal pump unloads 300 gpm.



Nomenclature

A_A	Area of annulus = $A_T - A_F$, ft.²
A_F	Area of float, ft.²
A_T	Area of tube, ft.²
C	Discharge coefficient, by experiment 0.83 for this type meter.
D_F	Diameter of float, ft.
D_T	Diameter of tube, ft.
g	Gravitational constant, 32.2 ft./sec.²
h	Head loss across annulus, ft. of fluid.
Q	Volume rate of flow, ft.³/sec.
V_f	Fluid velocity through annulus, ft./sec.
W_{EF}	Effective float weight, lb.; actual weight less weight of fluid displaced.
w_f	Specific weight of fluid, lb./ft.³
w_F	Specific weight of float, lb./ft.³

Flow Meter for Maximum-Minimum Flow

Lloyd M. Polentz
Robertshaw-Fulton Controls Co., Anaheim, Calif.

Sketched above is an unusual two-step rotameter which is easy to design, easy to build, and excellent for applications where the flow is not critical, but must be held between specified maximum and minimum values. An example might be a meter to control the flow of cooling water. In many cases the flow must be more than a certain minimum to insure adequate cooling; and it should not be more than a certain maximum to prevent waste of water.

A meter of this type can easily be tailored to the job at hand and can be turned out in the plant shop at considerably less than the cost of a conventional wide-range rotameter. It differs from the conventional, tapered-tube type in employing a barrel of transparent material such as Lucite or Plexiglas which has two concentric cylindrical portions of slightly different diameter. Its float is a stainless steel stove bolt. Standard pipe nipples are screwed into either end of the transparent block, while the upper and lower screen stops can be window screen or, better, they can be made of stainless steel wire mesh.

The two diameters of the barrel are calculated so that the float will ride at the top of the smaller diameter portion for flows above the desired minimum. If the flow reaches the predetermined maximum, the float will rise to the upper stop. Thus, any flow within the desired range will give a reading at the midpoint of the meter barrel.

To calculate the two barrel diameters we can use the conventional orifice formula since the rotameter is essentially a variable-area, constant-head-loss annular orifice, in which at any cross-section of the barrel the head loss, times the orifice area, is equal to the weight of the float, minus the weight of the liquid it displaces. The head loss can be determined from the fundamental relationship, $V_f = C\,(2gh)^{\frac{1}{2}}$, where the flow coefficient C is (ordinarily) a constant and has a value of about 0.83 as determined by experiment for this particular type of flow meter. Therefore:

$$V_f = C\sqrt{2gh} = 0.83 \times 8.02\sqrt{W_{EF}/A_F w_f} \quad (1)$$

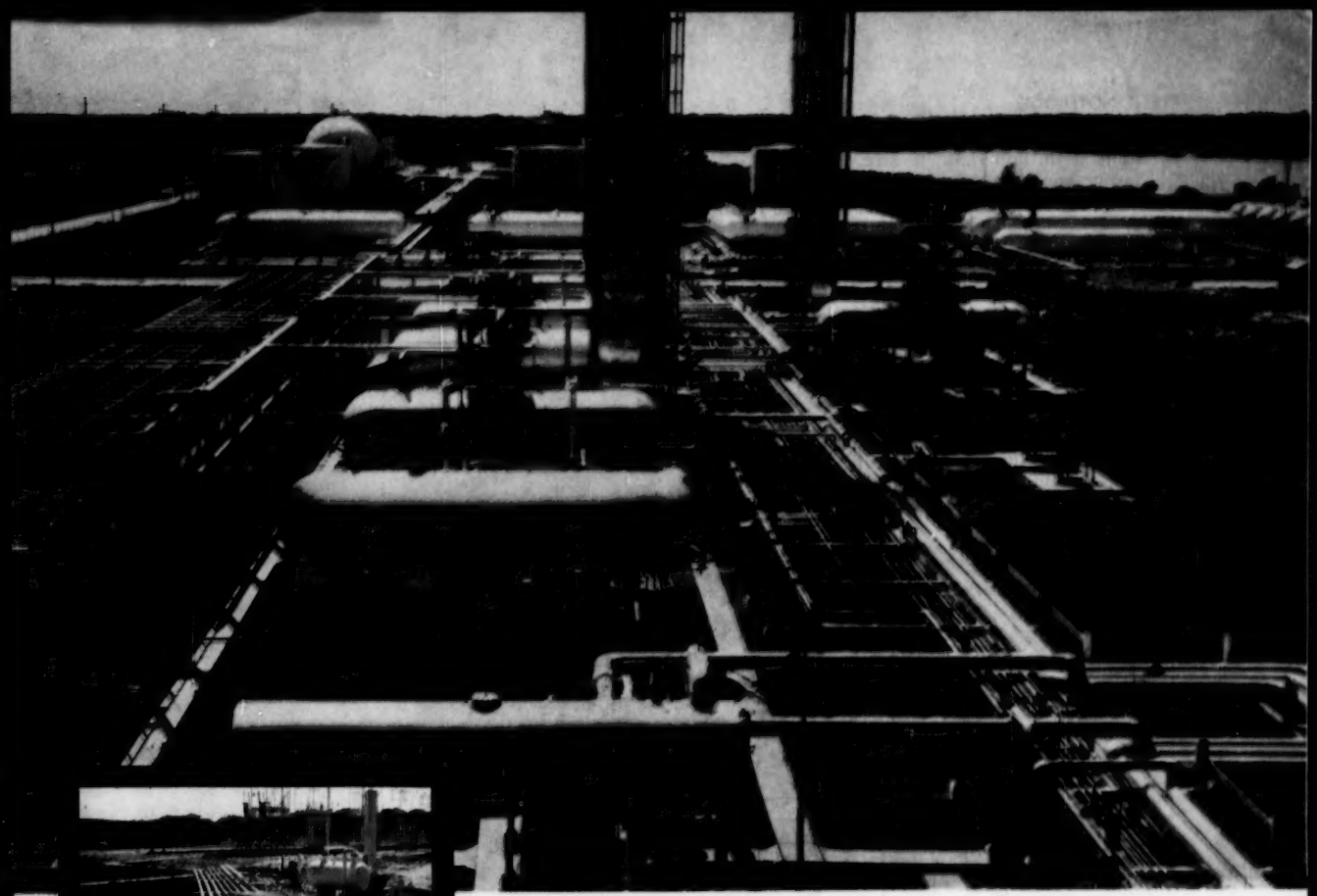
$$Q = A_A V_f = 6.66\, A_A \sqrt{W_{EF}/A_F w_f} \quad (2)$$

As an example of design, assume that the flow should be between 0.75 and 1.5 gpm. of water (w_f = 62.4 lb./ft.³). The stainless steel float (w_F = 490 lb./ft.³) will have a head diameter of D_F = 0.0379 ft. (A_F = 0.00113 ft.²) and a weight of 0.0149 lb. Its volume will therefore be 0.0149/490 = 0.0000304 ft.³ Its net, unbuoyed weight will be ($w_F - w_f$) × float volume or (490 − 62.4) × 0.0000304 = W_{EF} = 0.0130 lb. Q_1 at 0.75 gpm. = 0.75/60 × 1/7.48 = 0.00167 ft.³/sec. and Q_2 at 1.5 gpm. = 2 Q_1 = 0.00334 ft.³/sec.

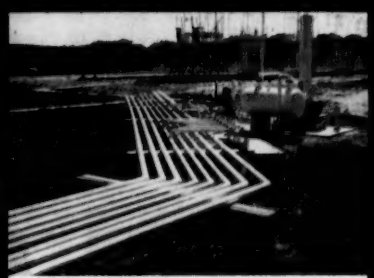
By Eq. (2):

$$Q = 6.66\, A_A \sqrt{130/0.00113 \times 62.4} = 2.86\, A_A$$

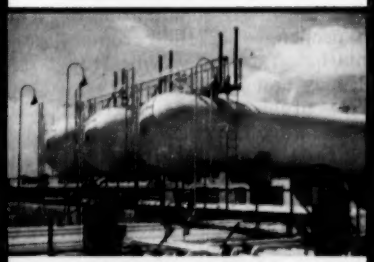
Then for Q_1 = 0.00167, A_A = $Q_1/2.86$ = 0.000584 ft.² and A_T = $A_A + A_F$ = 0.00171 ft.² Hence, D_T = 0.56 in. Drill $\frac{9}{16}$ in. and ream to size. Similarly, for the larger diameter, with Q_2 = 0.00334, A_A = 0.00117 ft.² and A_T = 0.00230 ft.² So D_T = 0.65



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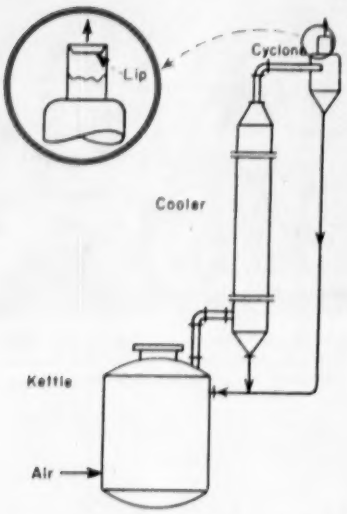
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in. Drill ¾ in. and ream to size.

Flows should be checked for both diameters. If one is critical it can be decreased by lightening the float by grinding a little off the bolt end. If it should be increased, this can be done by grinding a little off the head diameter.

Calculations of the same type can be used, of course, in designing a conventional tapered-tube rotameter, employing a Morse-type reamer and designing for maximum and minimum flows as above.



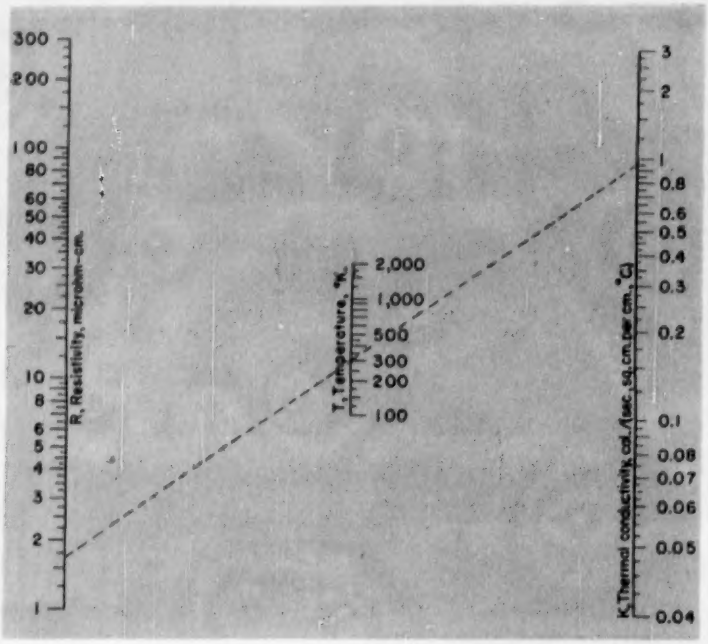
Outlet "Lip" Eliminates Droplet Carryover

David Wittenberg

Engineer, Kiryat Motzkin-Haifa, Israel.

Shown in the sketch is an installation used for oxidizing gas oil at 135 C. Air is introduced into the reactor and the gases given off pass up through a shell-and-tube cooler where they are cooled to 35 C. They then discharge to the atmosphere through a cyclone which they enter at about 5,000 fpm.

The cyclone is very effective in separating out the liquid mist except that a slight oil film formed on the outer surface of the cyclone outlet pipe and crept downward in waves. A simple and effective solution is shown in the enlarged view. This consisted in welding a truncated cone inside the upper end of the outlet pipe. The resulting "lip" effectively prevented any liquid carryover.



Metal Conductivity From Resistivity

Liang-tseng Fan

Department of Chemical Engineering, West Virginia University, Morgantown, W. Va.

It is often necessary to use new metals and alloys in chemical engineering design, or to use conventional ones under abnormal conditions. Very frequently data on physical properties is not readily available, in which case estimation of the unknowns from known physical properties may serve the purposes of design.

Thermal conductivity can be approximated as a function of temperature and electrical resistivity by use of the equation $K = 10^{-3}\ (5.02T/R) + 0.03$. (See Gilbert E. Doan, "The Principles of Physical Metallurgy," 3rd Ed., p. 217, McGraw-Hill Book Co., Inc., New York, 1953.) The nomograph above is based on this equation which is valid for pure metals and solution-type alloys. To apply the nomograph to the duplex alloys, the linear combination of the properties of their components based on the volume fraction may be used.

The problem line illustrates the case of copper at 20 C. To express the result in Btu./(hr., sq. ft. per in., °F.), multiply the result given in calories by 2,903.

Using an Air Pump as a Mist Eliminator

L. Bush

Physical Research Laboratory, Dow Chemical Co., Midland, Mich.

In the laboratory pyrolysis of oil vapors, coal or oil shale, a mist is usually created which is difficult to remove from the gas stream. It rapidly clogs glass

for the most efficient recovery of platinum metals . . .



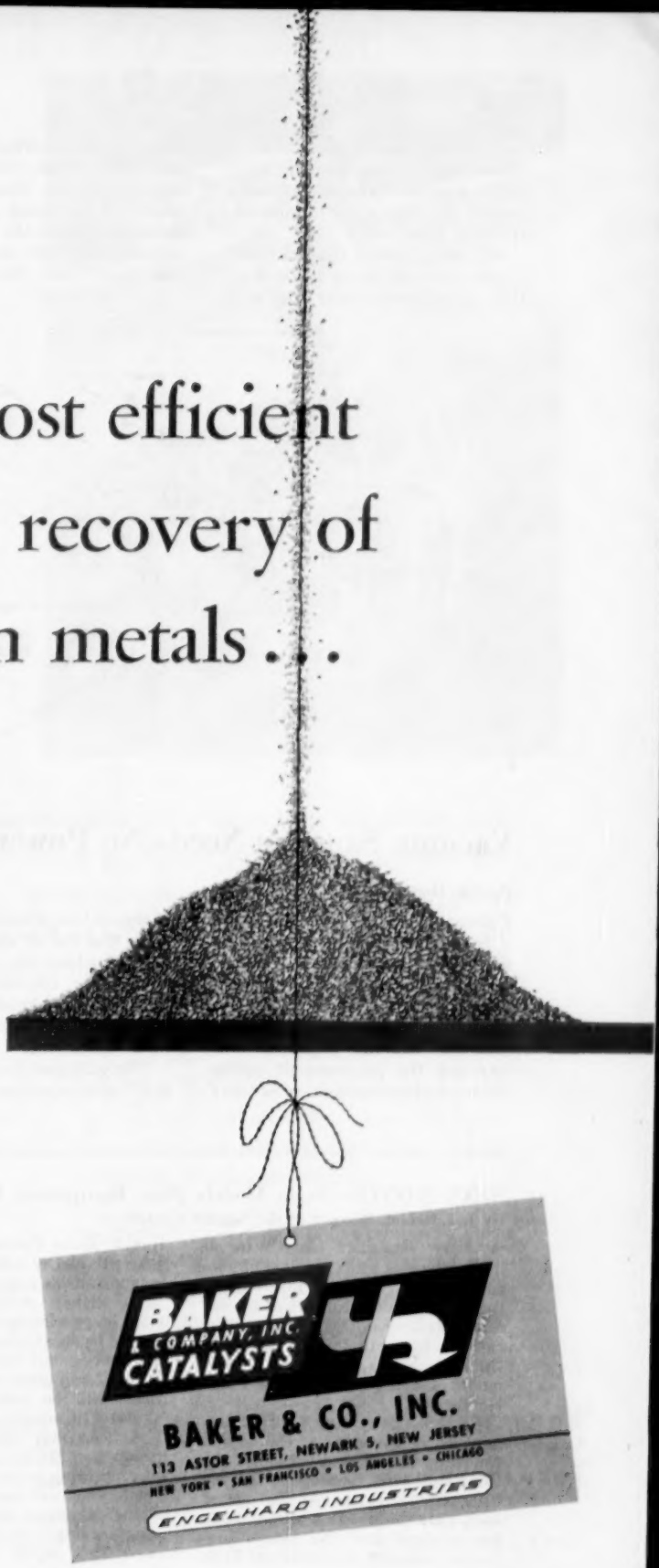
Here, specialized knowledge, experience and facilities combine to provide the chemical industry with a most efficient service for maximum recovery of platinum metals from spent catalyst.

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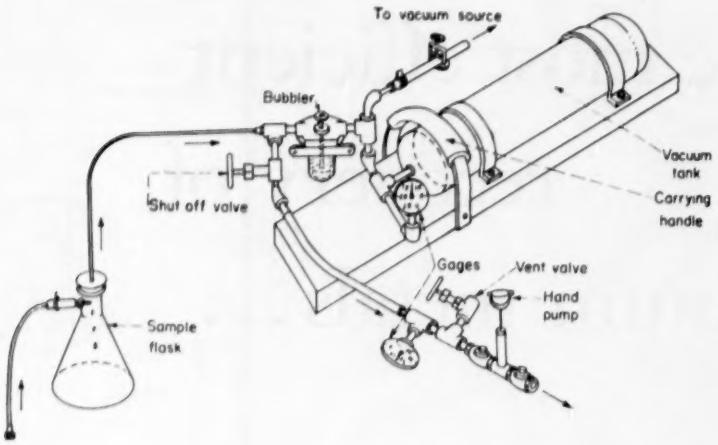
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THE WORLD'S LARGEST WORKERS AND REFINERS OF PRECIOUS METALS

wool filters, is only partially removed by centrifuging and, if air is present, creates a hazard should an electrostatic precipitator be used.

We have found that a small rotary-vane air pump is an effective mist precipitator for this use. Cold traps are placed in the inlet and outlet, with a valved bypass between. The centrifugal action of the vanes throws mist droplets against the pump housing, causing them to consolidate and drain into the outlet cold trap as a liquid.



Vacuum Sampler Needs No Power

Paul B. Hodges

Pollution Control Engineer, Monsanto Chemical Co., Monsanto, Ill.

It is often necessary to sample water or sewage wastes continuously at locations where neither electric nor air power is readily available. Sometimes in other locations extreme depth of sewers and the presence of corrosive or flammable vapors may make the use of electrical equipment inadvisable. The low-cost, dependable, corrosion-proof vacuum sampler sketched above was developed to overcome these common difficulties.

The sampler is powered by a 6 × 24-in. stainless steel vacuum tank. The whole unit is readily portable. Before use the tank is evacuated to 20 mm. Hg or lower by taking the unit to a vacuum source such as a laboratory pump or multi-stage steam jet ejector and connecting to the hose. When the unit is returned to the site, it is connected to the filter flask which should be suspended in the sewer manhole, out of direct sunlight. A length of polyethylene tubing runs from the flask side arm to the sewer, being weighted down with a tubing connector.

To start the unit the flask is evacuated by means of the hand pump until water barely starts to drip in. If the vacuum is too great it can be relieved with the needle vent valve. Then the shut-off valve is closed and sampling continued by displacement of air through the sight-feed bubbler to the vacuum tank. Sampling rate is controlled by adjusting the bubbler needle valve which then never needs to be changed unless dirt or water is inadvertently drawn into it.

With the unit shown, sample sizes can be controlled at from 1 to 3 liters in 24 hr. If larger samples are needed a larger vacuum tank should be used. To insure a reasonably constant sampling rate for 24 hr. the vacuum tank volume should be more than twice the sample size desired and the filter flask should be protected against extreme temperature changes.

To discourage tampering, the hand vacuum pump can be disconnected daily and a cover locked over the bubbler, valves and gage. In extremely cold weather a small air dryer should be inserted in the air line near the flask and ahead of the bubbler to prevent ice crystals from clogging the bubbler needle valve.

Total cost of materials for each unit, including the hand vacuum pump, is about $55.

We use four such samplers. To eliminate the need for moving them we have a small gasoline-engine-powered vacuum pump on a station wagon. Although the four sampling stations are nearly a mile apart, they can be tended in a total of about 45 min. per day, including taking samples to the laboratory.

NEXT MONTH: Scale Models Plan Equipment Replacements
By J. J. Seidel, Winner of the August Contest

★ How Readers Can Win

$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

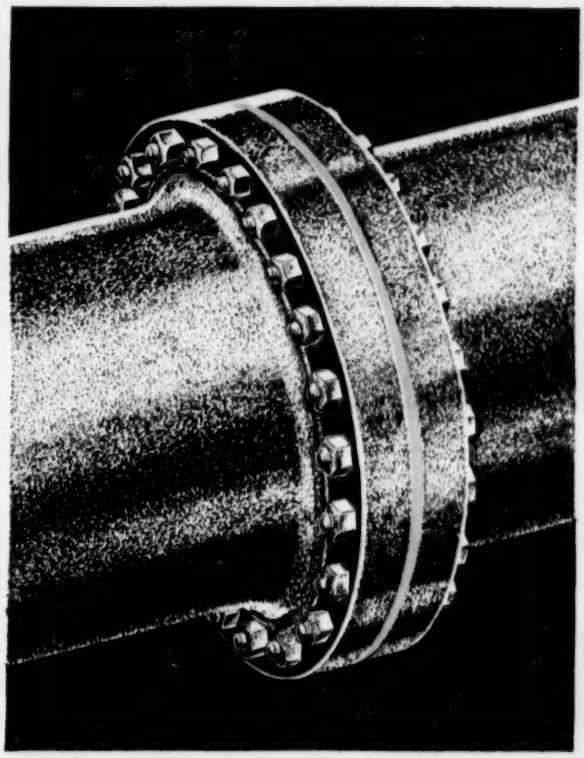
Each month's winner will be announced in the issue of the second following month, and published the third following month.

$100 Annual Prize—At the end of each year the monthly winners will be rejudged and the year's best winner awarded an additional $100.

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Articles may deal with plant or production "kinks", or novel means of presenting useful data, for interest to chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

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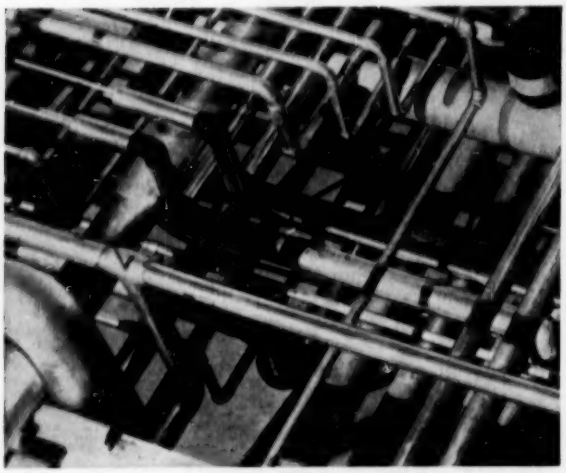
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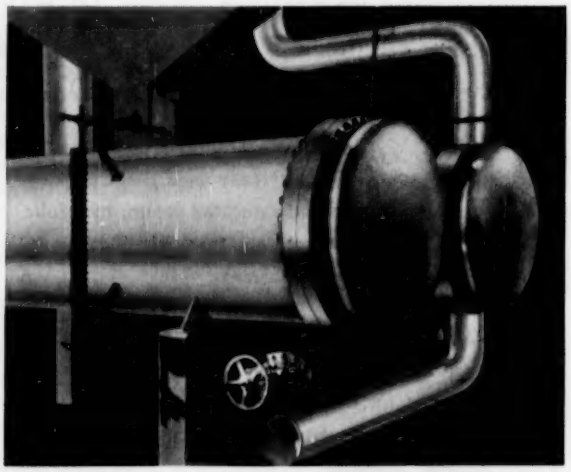
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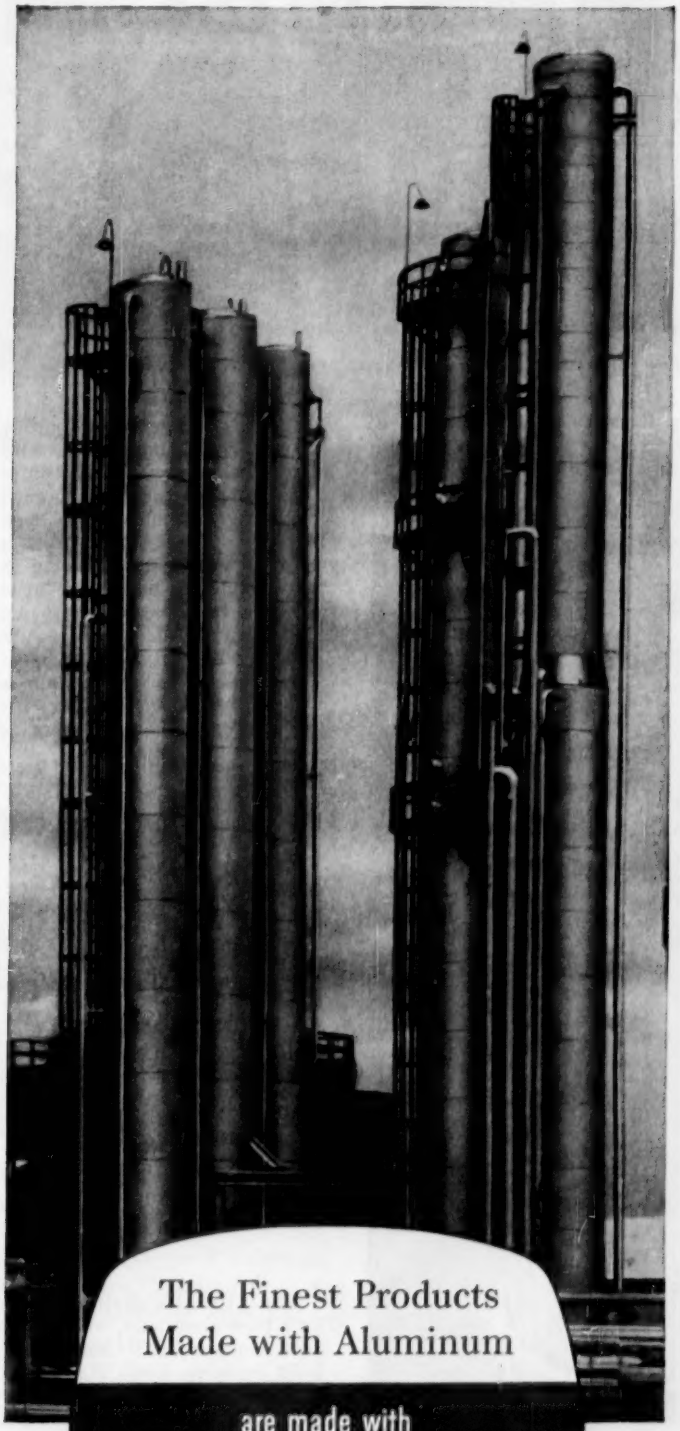
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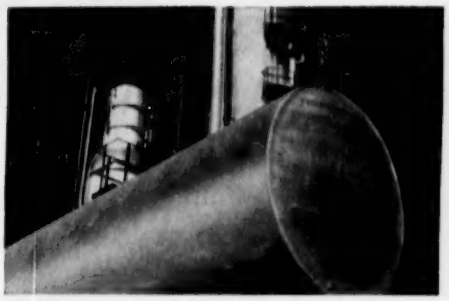


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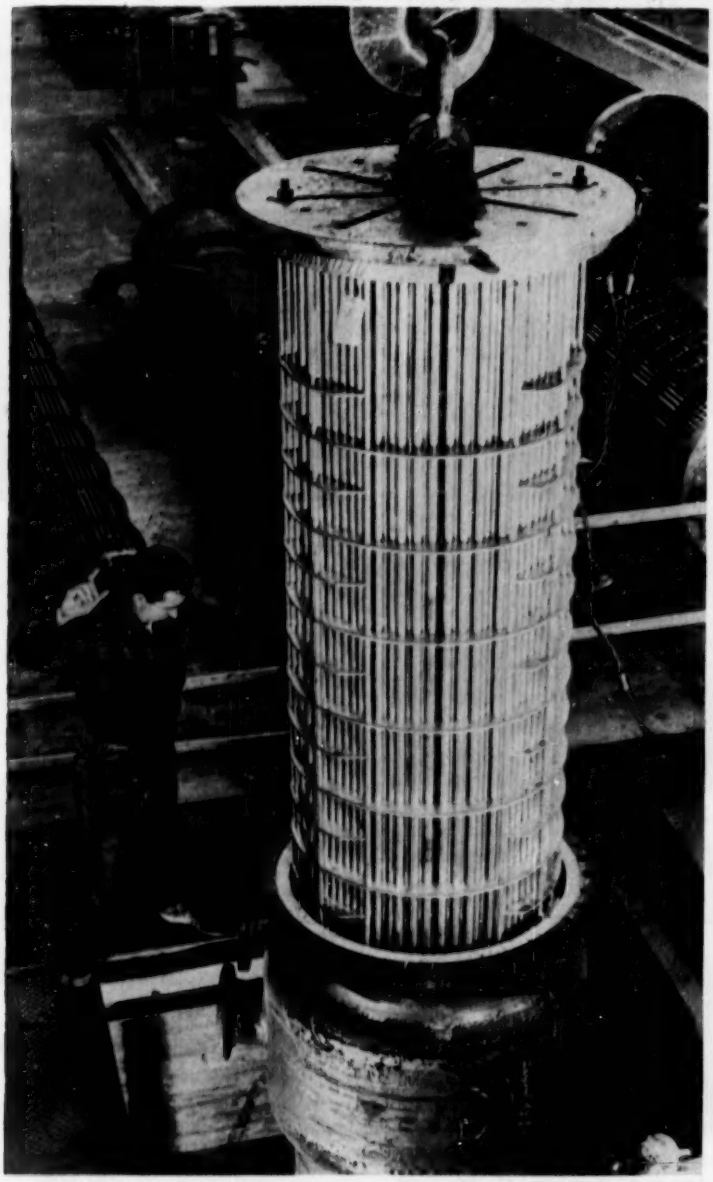
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REYNOLDS ALUMINUM

Al Alloy Variety Spurs Use in Exchangers

Multiplicity of aluminum alloys—including new high-strength alloys—gives wide choice of properties, equipment designs, for process heat exchangers.

R. W. Flournoy, Chief Chemical Engineer, Reynolds Metal Co.*



ALUMINUM TUBE bundle assembly in a shell-and-tube process heat exchanger. Typical tubes are fabricated of alclad 3003 alloy. (C. F. Braun).

There is a long list of reasons for the increasing use of aluminum in chemical process equipment: ease of fabrication, good corrosion resistance, low cost, light-weight properties. But a major up-and-coming factor is the availability now of a large number of aluminum alloys accepted in pressure code specifications.

For instance, the following is a list of recommended alloys for heat exchangers, covering a wide range of properties:

Tubes	3003-H14
	Alclad 3003-H14
	6061-T6
	6062-T6
Tube sheets	6061-H112
	Alclad 6061-H112
	5052-H112
	5083-H112
	5086-H112
Shells and headers	1100-H14
	3003-H112
	Alclad 3003-H112
	5052-H112
	5083-H112
	5086-H112
	5154-H112
Flanges, fittings	3003-F
	6061-T6
Baffles	1100-H14
	3003-H14

The 1100 designation is for 99% pure aluminum, while alloys 3003 contain 1.2% Mn. Series 5052 contains 2.5% Mg, 0.25% Cr. And 5154 has 3.5% Mg, 0.25% Cr. Alloys 5083 have 3% Mg, while 5086 contains 4% Mg.

The 6061 alloys have 1% My, 0.25% Cr, 0.25% Cu, 0.6% Si. Alloys 6062 contain the same alloying amounts, except for 0.09% Cr.

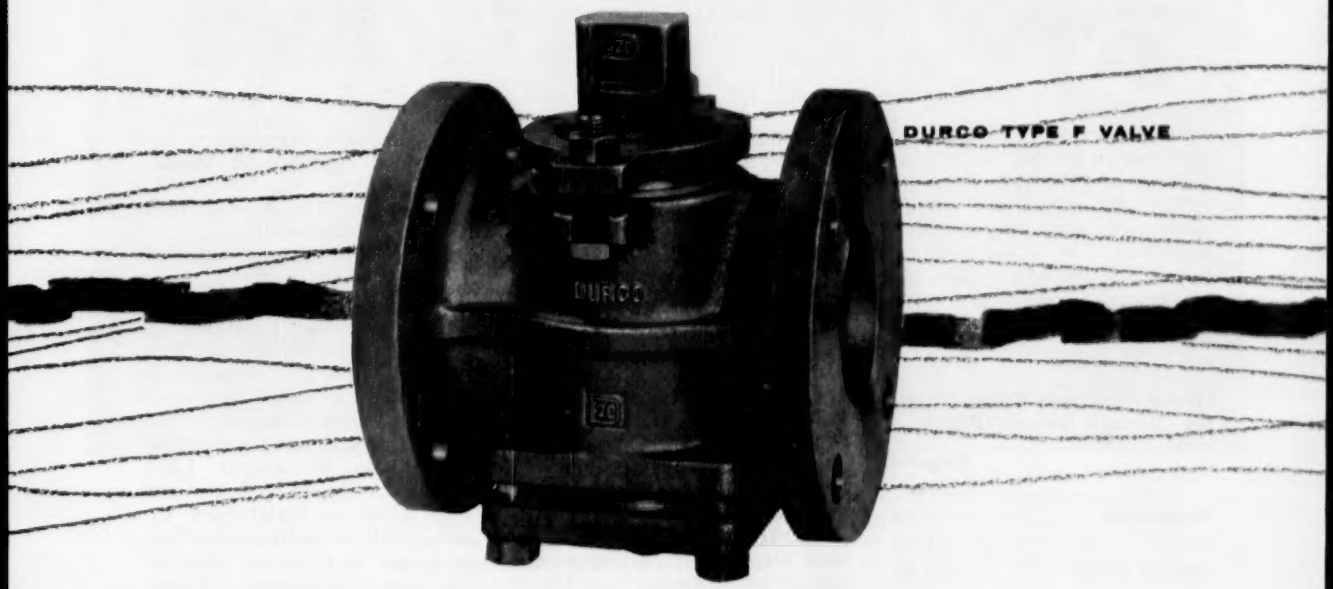
Alclad 3003 is a duplex alu-

* Meet your author on page 347.

SAVINGS

on maintenance run to thousands of dollars at

Michigan Chemical Corporation • Saint Louis, Michigan



Previous valves on a chlorinator manifold at Michigan Chemical Corporation leaked so badly they required daily re-packing. The leaky valves were replaced in 1952 by Durco Type F valves. These original Type F valves are still in service and they have "resulted in saving thousands of dollars by reducing operating down time and maintenance labor."

Michigan Chemical Corporation is a basic manufacturer of industrial, agricultural, and pharmaceutical chemicals, and is a leading producer of insecticides, bromine, bromides (organic and inorganic) magnesia, salt, and rare earth oxides, compounds, and metals. The installation described here is just one of several Durco valve installations at its Saint Louis, Michigan, plant.

Durco chemical service valves, pumps, and other engineered equipment can probably save money for you.

For answers to your tough corrosion problems, write or call The Duriron Company, Inc., Dayton, Ohio.

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Take Your Pick: Physical Properties of Aluminum Alloys—Table I

	75F.	300F.	400F.	500F.	600F.	−112F.	−320F.
Alloy 1100-H14							
U.T.S. psi	17,500	13,000	9,500	3,500	2,500	19,500	28,500
Y.P. psi	16,000	9,000	5,000	2,000	1,500	17,000	19,000
% Elong. in 2 in.	20	22	25	85	90	23	42
Alloy 3003-H14							
U.T.S. psi	21,500	17,500	14,000	10,000	5,000	24,500	36,000
Y.P. psi	19,000	12,500	8,000	4,000	2,500	20,000	23,500
% Elong. in 2 in.	16	17	22	25	40	18	30
Alloy 5052-0							
U.T.S. psi	27,000	20,000	15,000	11,000	7,500	30,000	42,300
Y.P. psi	12,000	10,000	9,000	7,000	4,500	13,000	16,600
% Elong. in 2 in.	30	55	65	100	105	29	24
Alloy 6061-T6							
U.T.S. psi	45,000	32,000	19,000	7,000	4,000	49,000	60,000
Y.P. psi	40,000	30,000	16,000	5,000	2,500	42,000	47,000
% Elong. in 2 in.	17	18	25	55	90	18	22

minum compound with a core of 3003 alloy bonded to a thin cladding of 7072 (1% Zn).

The 3003 alloys are of the strainhardening class (not heat treatable). They come in an intermediate temper and tubes can be expanded into tube sheets without difficulty.

Where Aluminum Alloys Fit Into the Galvanic Series—Table II

	Potential, Volts*
Magnesium	−1.73
Zinc	−1.00
Aluminum 5056-0	−0.87
Pure aluminum	−0.85
Aluminum 5052-0	−0.85
Aluminum 1100-0, 1100-H18, 3003-0, 3003-H18, 6061-T6, 6062-T6	−0.83
Cadmium	−0.82
Aluminum 2017-T4, 2024-T4	−0.68
Mild steels	−0.67
Lead	−0.55
Tin	−0.49
Brass (60-40)	−0.28
Copper	−0.20
Stainless steel (18-8)	−0.15
Monel	−0.10
Silver	−0.08
Nickel	−0.07
Inconel	−0.04

* Measured in a 1 normal sodium chloride solution containing 0.3% hydrogen peroxide (N/10 calomel scale).

Tube sheets are generally constructed of the higher strength, hard alloys 5052, 5083, 5086, 6061.

Aluminum alloy properties are shown in Table I. ASTM specifications B-178, B-234, B-247, B-273 and B-274 apply to aluminum heat exchangers.

Aluminum can be used for service up to 500 F. However, the ASME code limits service to 400 F.

It should be noted that the physical properties of aluminum improve at low temperatures. Aluminum heat exchangers are recommended and used for liquefied air, oxygen, nitrogen and petroleum products.

Al Resists Corrosion

Aluminum is chemically resistant to many acid and neutral materials, but is not recommended for strong alkaline environments.

Consider aluminum heat exchangers and condensers for the following types of corrosion environments:

- Sea water, fresh water, distilled water and demineralized water.
- Petroleum products.
- Liquid oxygen, peroxide solutions and nitric acid.
- Organic solvents such as benzene, toluene, alcohol, ether and acetone.
- Fatty acids and oils.
- Food products and pharmaceuticals.
- Ammonia, ammonium nitrate and ammoniated ammonium nitrate.
- Carbon dioxide and carbonic acid solutions.
- Sulfur, mercaptans, hydrogen sulfide and hydrogen cyanide.

This corrosion resistance of aluminum, while giving long equipment life also prevents accumulation of corrosion products on heating surfaces. The rate of heat transfer—thermal conductivity is around 1,570 Btu./(hr.) (sq. ft.) (F./in.) for 1100 alloy—is maintained, together with an undiminished flow of gases and liquids through the heat exchanger. Clean, smooth aluminium surfaces also resist deposition of calcareous, protienaceous or rubbery scale.

Avoid Galvanic Corrosion

Bimetallic couples should be avoided in aluminum heat exchangers to prevent galvanic corrosion. Aluminum exchangers should be fabricated entirely of aluminum, avoiding the use of dissimilar metals, when the environments are electrolytes.

Aluminum tubes may be used in ferrous or nonferrous alloy tubes sheets when non-electrolytes, such as condensate or petroleum materials, are the environment. Stainless steel and aluminum bimetallic couples do not usually result in severe galvanic corrosion.

Crevice corrosion can be re-



CORROSION'S FOCAL POINTS are easy to detect with a new Amercoat testing method using iron and caustic indicators in a saline gelatin bath. On the welded and scored steel panels shown above after test, unworked surface areas turned red to indicate cathodic properties; but the weld, scores and edges turned blue (here shown blackened) to reveal themselves as anodic corrosion breeders. Rivets, threads, crevices and abrasions also show anodic under test. Unless such areas are effectively sealed from moisture, oxygen and ions they will erupt as focal points of corrosion cells.

How to protect "trouble spots" against corrosion

Ask a corrosion engineer where metal corrosion is likely to attack first. Chances are that he will name rivets, threads, sharp edges, angles, crevices and welds. These are the areas of stress concentration, work hardness, fissures and abrasions. They tend to be anodic and actually breed corrosion. And although they warrant increased protection, conventional coatings pull away from their sharp profiles and leave them inadequately covered.

Amercoat No. 87, a true vinyl mastic, protects these spots in a single coat 10 mils thick, whereas other coatings fail to build 5 mils in three coats. It cuts maintenance painting costs up to 50% because you don't have to re-erect staging and scaffolds for additional coats, and you get results that last.

No. 87 combines the time-tested chemical and weather resistance of vinyl coatings with the thickness of mastic, yet it is easily sprayed with standard equipment over a suitable primer. Available in white, gray, black and aluminum. Use it for enduring protection at lower cost per square foot per year. **Complete details mailed on request.—Amercoat Corp., South Gate, Calif.**

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Comparing Costs of Metal Floating Head Exchangers—Table III

Heat Transfer Surface, Sq. Ft.	200	400	1,000	2,000	4,000	6,000
Dollars/Sq. Ft. Heat Transfer Surface*						
Steel, 14 BWG tubes	$11.00	$7.70	$5.00	$3.75	$3.20	$3.15
Aluminum 3003, 16 BWG tubes	13.00	9.10	5.90	4.50	3.75	3.70
Brass, 16 BWG tubes	14.70	10.20	7.30	5.95	5.15	5.10
5% chrome 14 B WG tubes	20.00	15.00	7.40	8.70	7.80	7.75
Stainless 304, 16 BWG tubes	25.00	19.00	14.00	12.00	10.30	10.25

* Costs are before installation. Shell is steel in all exchangers.

duced by designing heat exchangers with smooth, continuous surfaces. Liquor pockets which cannot drain or flow at normal rates should be eliminated in the design. Rivets, crevices between lapped plates of aluminum, and absorbent gasketing should also be eliminated.

Flow rates of 3-10 ft./sec. through aluminum exchangers are recommended; higher rates may induce erosion if solids are suspended in the liquids.

In aqueous solutions, containing a combination of heavy metal and chloride ions, aluminum is susceptible to pitting type corrosion. Small galvanic cells are set up with the center of the pit anodic and the periphery cathodic. These cells cause galvanic current to flow, and anodic aluminum base materials go into solution.

Alclad alloys have built-in resistance to this form of attack. The 7072 cladding with 1% Zn is anodic to the 3003 core. Average cladding thickness is 10% minimum of total thickness. This cladding acts as a sacrificial anode for the base material (Table II).

Costs Are Favorable

A cost comparison of aluminum heat exchangers with other types of alloy exchangers is shown in Table III. A substantial advantage for aluminum is due to its light weight, which results in an additional cost saving during installation of the heat exchanger.

Maintenance costs are low. Corrosion resistance and scale resisting properties of aluminum alloys keep tube replacements and tube descaling operations down to a minimum.

Aluminum exchangers do not require external protective coatings for the shell and outlet piping; an additional reduction in cost.

Fabrication and Design Techniques

Heat exchangers are readily fabricated of aluminum: standard techniques include shearing, forming and welding. Shielded arc inert gas welding, using high frequency stabilized alternating current, is the recommended welding practice. During fabrication, aluminum should be protected against surface contamination by imbedded iron or copper. Also, alloy tempers must be selected which permit sufficient work hardening during the forming operations.

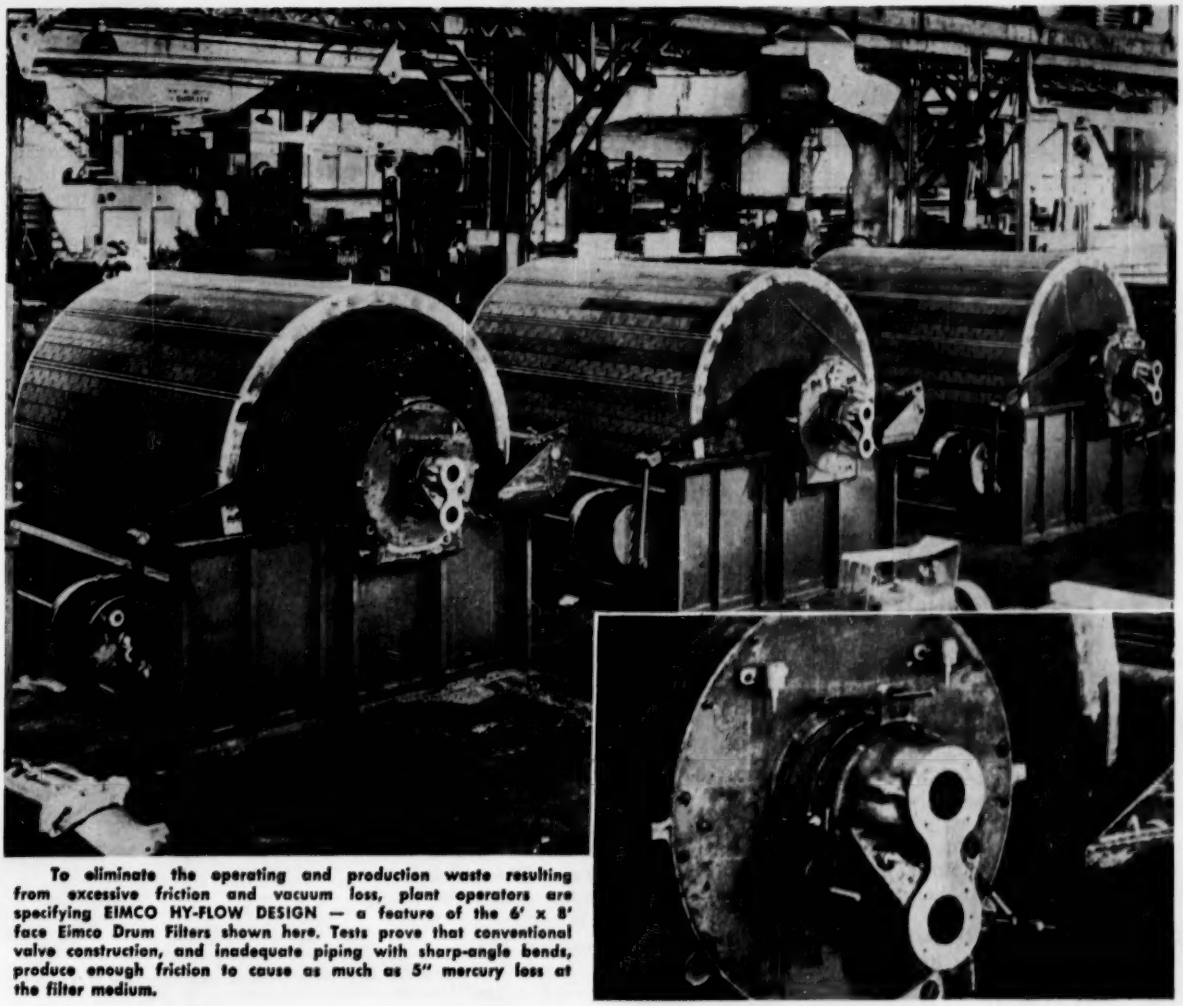
Tubes can be rolled or welded into tube sheets. Welding of tubes to tube sheets has produced good results and several new welding techniques have been developed. Welded tubes avoid "leakers" and excessive cold working of tube ends.

Aluminum heat exchangers for operation under pressure should meet the ASME Boiler and Pressure Vessel Code Section VIII, 1956, for unfired pressure vessels.

Table IV shows values of maximum allowable tensile stress for use in calculations for shell

Maximum Allowable Tensile Stress for Unfired Pressure Vessels, Psi.—Table IV

Aluminum Alloy	150F.	200F.	250F.	300F.	350F.	400F.
1100-0	2,350	2,300	2,100	1,850	1,600	1,300
1100-H112	2,800	2,550	2,250	2,000	1,700	1,400
1100-H14	3,900	3,650	3,300	3,000	2,700	2,200
3003-0	3,150	2,900	2,700	2,400	2,100	1,800
3003-H112	3,250	3,000	2,800	2,500	2,200	1,900
3003-H14	4,850	4,700	4,400	4,000	3,500	3,100
5052-0	6,250	6,200	6,000	5,400	4,650	3,900
5052-H112	6,250	6,200	6,000	5,400	4,650	3,900
5052-H34	8,500	8,400	7,700	6,900	6,100	5,300
5154-0	7,350	7,350	7,000	6,400	5,656	4,900
6061-T6	10,100	9,650	8,850	7,500	6,000	4,300
Alclad 6061-T6 as welded	5,900	5,700	5,400	5,000	4,200	3,200



To eliminate the operating and production waste resulting from excessive friction and vacuum loss, plant operators are specifying EIMCO HY-FLOW DESIGN — a feature of the 6' x 8' face Eimco Drum Filters shown here. Tests prove that conventional valve construction, and inadequate piping with sharp-angle bends, produce enough friction to cause as much as 5" mercury loss at the filter medium.

EIMCO HY-FLOW DESIGN HANDLES MORE AT LESS COST

EIMCO HY-FLOW DESIGN enables Eimco Continuous Filters to handle all types of slurries at a high filtration rate and still meet rigid product specifications.

Eimco traced a major source of operating-production "ills" to vacuum loss from friction generated as filtrate and air passed thru inadequate piping and improper flow systems.

This touched off an extensive research and development program resulting in **Eimco Hy-Flow Design.** Sharp, friction-producing bends are diminished to provide a smooth, straight-thru flow of liquid and gas to enlarged ports . . . minimizing turbulence and vacuum loss. Increased capacity, dryer filter cakes, lower maintenance and downtime costs, improved drainage, no blow back and longer filter media life are some of the important advantages achieved by **Eimco Hy-Flow Design.**

Considerably more than installing larger pipes and re-arranging valve construction was necessary. It called for careful selection of pipe sizes to achieve proper balance between flow rate and efficient filtering, drying and discharge. It involved precision design changes and careful integration of many external and internal features of Eimco filter construction such as: Drum connections, ferrules, pipe spacing, drainage sections, grid patterns and many others.

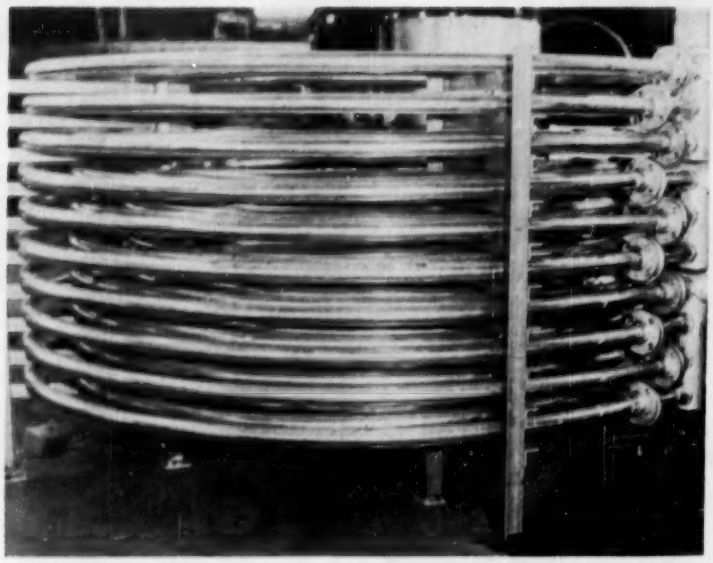
Using **Eimco Hy-Flow Design,** many process firms spend fewer investment dollars for smaller Eimco Filters to meet requirements. Experience and know-how in research, designing and manufacturing are your guarantee that Eimco specialized equipment will meet plant requirements, economically. Let us tell you more about the valve and high capacity characteristics of **Eimco Hy-Flow Design.**

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B-384



BENT COIL exchanger, fabricated of aluminum, fights acid corrosion. Strong alloy 6061 is recommended for tubes. (Acme Coppersmithing)

thickness, tube dimensions, etc. These stress values are appreciably below ultimate tensile strength—some are based on welded structures using stress values for annealed temper.

Types of Exchangers Available

Aluminum heat exchangers come in a variety of forms, from the simple submerged pipe coil to complicated shell and tube types. Heat exchangers of this latter type maintain flow rates up to 20% greater than that for materials which do not have smooth surfaces. Generally, heat transfer in aluminum heat exchangers is 5 to 50% greater than in ferrous alloy heat exchangers. Aluminum condensers are a type of heat exchanger which has found wide application (as condensate surface condensers) in electric power generating stations.

Heat exchangers are produced from flat sheets of aluminum bonded together, in which a pattern of tubes are formed by hydraulic pressure while the sheets are held in forming dies.

Aluminum plate coil heat exchangers can be externally coated with a fluorocarbon plastic in thicknesses up to 0.020 in. and chemically resistant up to 300 F.

Aluminum covers for insulation on tube and shell heat exchangers find wide application. Foil and sheets for such covers are easily attached with self-tapping sheet metal screws or aluminum straps. The reflectivity of aluminum assists the insulation in retention of heat, particularly radiant heat.

Aluminum insulation covers are weatherproof, attractive in appearance and can be reused when it's necessary to inspect the underlying insulation.

New Tube Designs

Aluminum tubing are produced in special shapes for heat exchanger applications: finned tubes for heating gases with liquids; straight tubes; traced tubes; helical fins formed from flat fin stock and pressed onto a suitable tube. Aluminum fins can be rolled into aluminum tubing, and finned tubes are available with exterior aluminum fins and an interior tube surface of ferrous or nonferrous alloy.

Aluminum steam tubes for ammonium nitrate dryers have been produced with external radial fins (aluminum extrusions can be produced with both internal and external radial fins).

A simple aluminum extrusion is the duplex or traced tube with passages for flow of two materials. This simple heat exchanger handles the transfer of ammonium nitrate solutions, fats and fatty acids and viscous petroleum products requiring heat from steam or hot water. Also, the trace line can be used for cooling water or refrigerant in product lines.

New Alloys Available

The new high-strength magnesium alloys 5083 and 5086 are very suitable for heat exchanger fabrication. Plate, sheet and extrusions can be purchased in the 5083 alloy. These alloys provide ultimate tensile strengths of 35,000-45,000 psi. Both alloys can be welded. Welds retain 80-90% of the original strength in plate or sheet form.

Aluminum heat exchangers for sea water evaporators and condensers are a new application approaching the experimental stage. Aluminum continues to show its advantages for heat exchanger fabrication as new alloys, new techniques and new uses are developed.

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Successful Extrusion of Molybdenum Metal

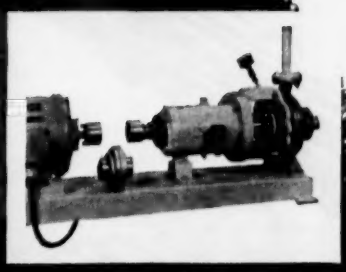
Commercial extrusion of molybdenum tubing is now a reality.

A new extrusion process has been developed by Wolverine Tube, in cooperation with Climax Molybdenum Co. In the past, the high strength of the material at extrusion temperatures has been a barrier to successful commercial extrusion of the metal.

Molybdenum tubing is available for evaluation purposes. Dimensions of the tubing: less than 1-in. outside diameter; approximately 0.1-in. wall thickness; and 3-6 ft. long. Tensile strength is 70,000-100,000 psi, and yield strengths cover the range of 60,000-90,000 psi.

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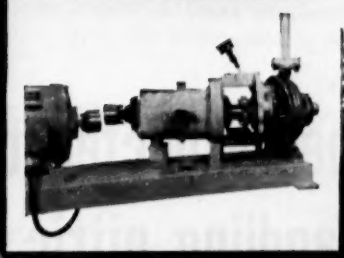
1.



Remove spacer from coupling.

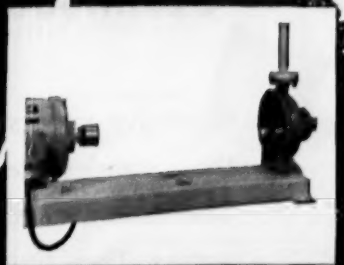
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2.



Remove cap screws.

3.



Remove the pump. Note: Neither suction or discharge lines are disturbed, nor is motor or alignment affected.

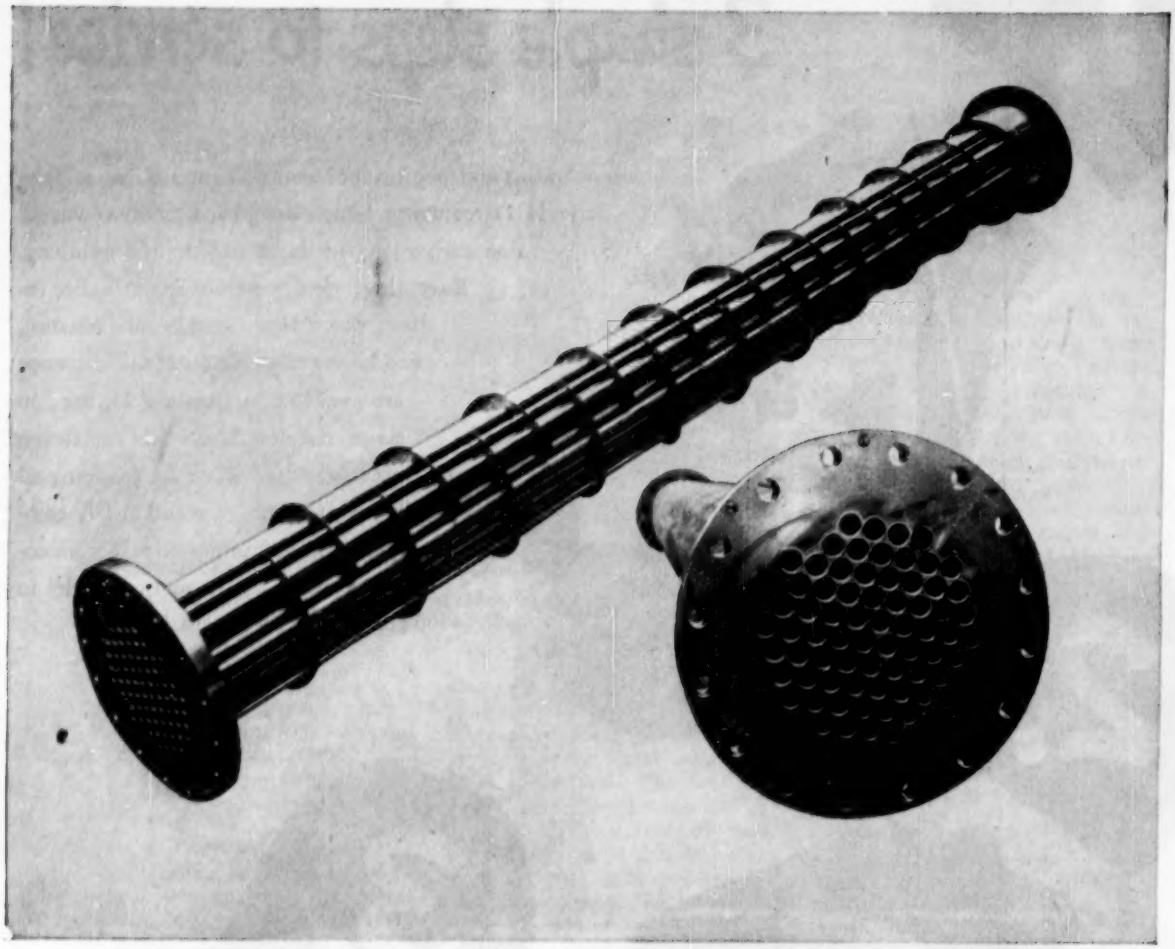
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Corrosive vapors of 60% nitric acid gnawed through an average of three stainless-steel tube bundles a year in a chemical firm's condenser. Maintenance and replacement costs were running as high as $18,000 a year. Then titanium tubes were installed. Based on a service life of 10 years, titanium will save at least $162,000 in maintenance and replacement costs.

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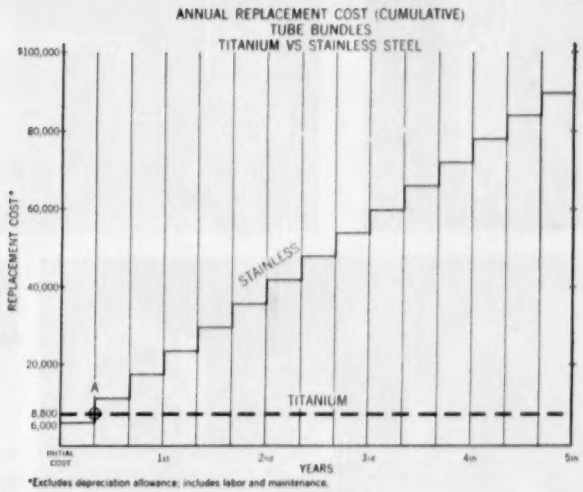
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In your process-development work, take full advantage of the corrosion and cavitation resistance, light weight and high strength of titanium . . . important considerations for continuous flow, high temperature and pressure processes. For further information, get in touch with Du Pont. And be sure to mail coupon below for an informative booklet about titanium—its properties and applications. E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Titanium Market Development Section, Wilmington 98, Del.

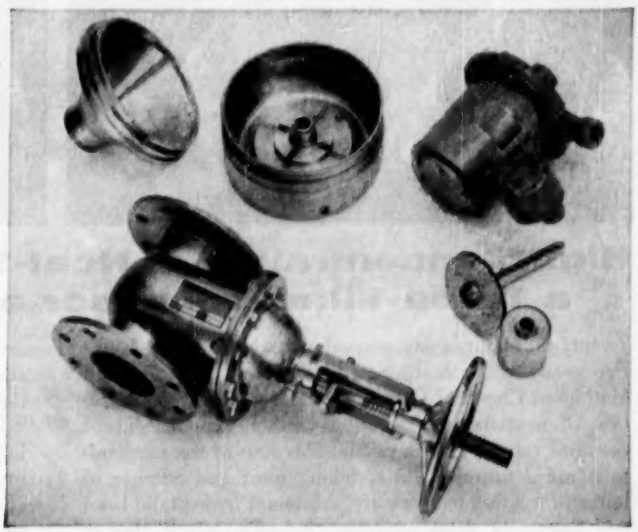
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INITIAL AND ANNUAL REPLACEMENT COSTS of titanium and stainless tube bundles are compared above. Initial cost of the titanium tube bundle, shown at left, is $8,800, vs. $6,000 for stainless. But note how the $2,800 difference is absorbed within 4 months of service (Point A). Savings are approximately $81,000 after 5 years . . . $162,000 after 10 years, the expected service life of titanium tubes.



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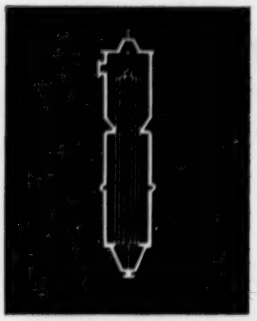
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Titanium N-2420-25, Wilmington 98, Delaware

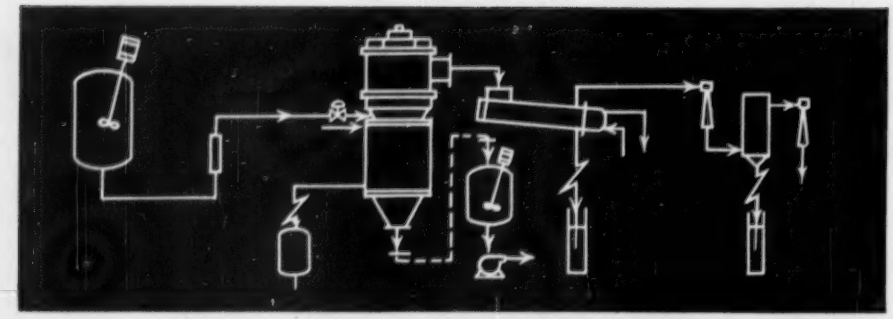
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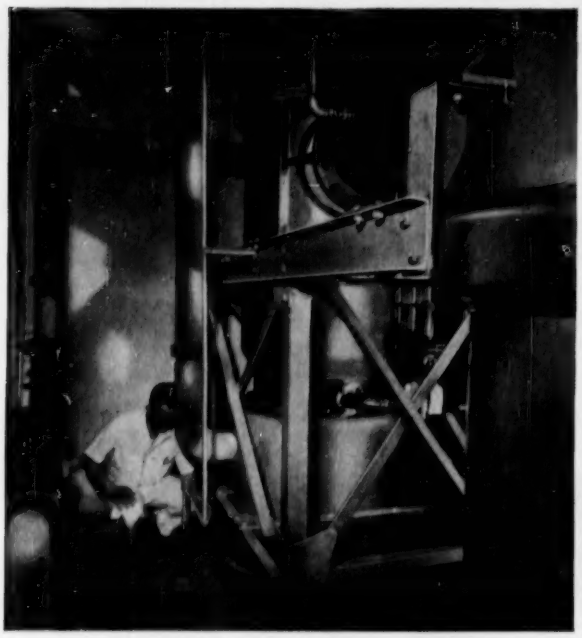
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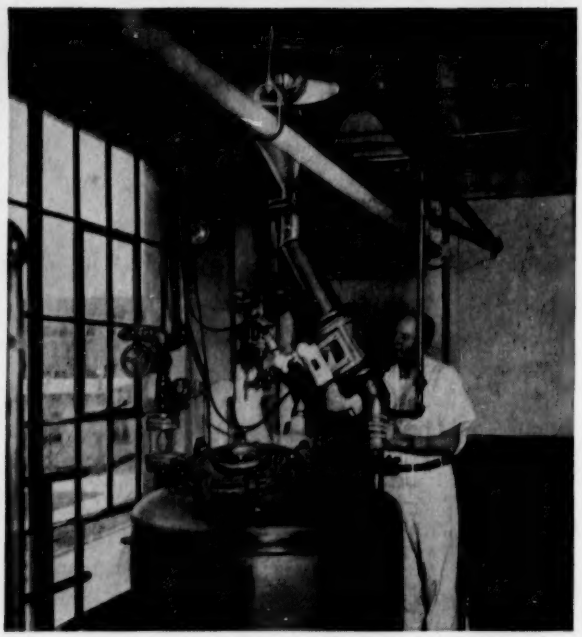
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OCTOBER 1957

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Man of the Month "Dusty" Rhodes retires from his post as head of chemical engineering at Cornell. The school will honor him this month with a testimonial dinner in N. Y.

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Minneapolis-Honeywell will turn out a new line of electronic industrial controls . . . Gulf Oil plans a new benzene and toluene plant at its Port Arthur, Tex., refinery.



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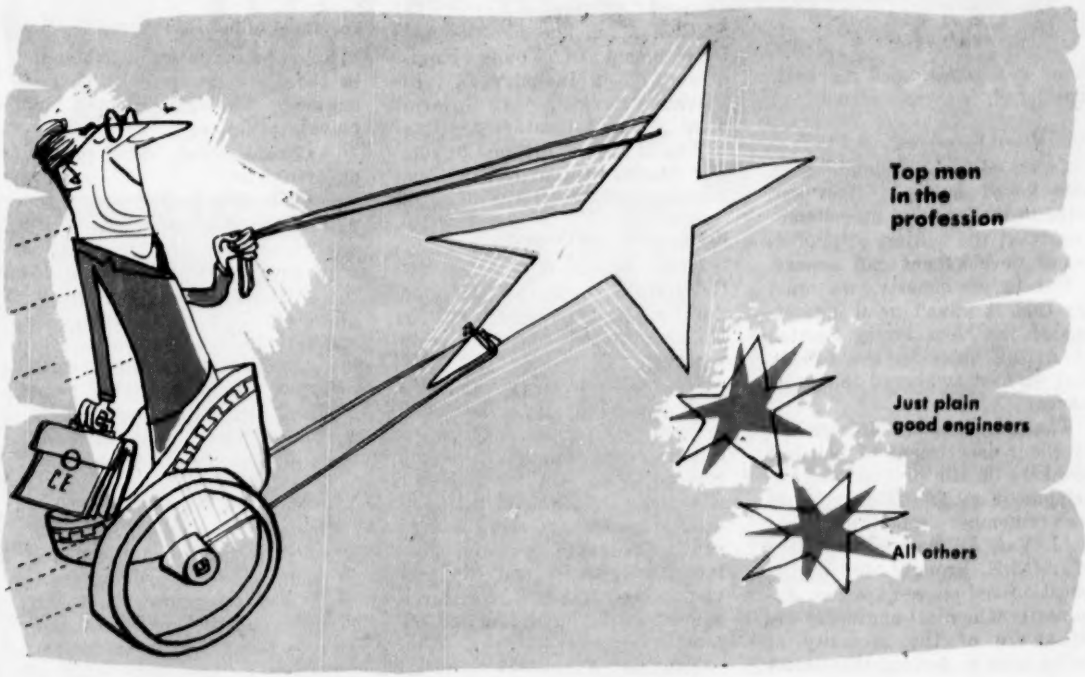
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Q. How can a young engineer develop himself professionally?

A. Hitch Your Wagon to a Star

Here's a tale of several cities. With an assist from our news bureaus in San Francisco and Dallas, we report on one of today's most-often discussed topics.

Wherever engineers gather this year their conversation drifts toward: salary surveys; Is there really an engineer shortage?; changing jobs; and professional development.

In fact, professional development — especially, what the young engineer can do to develop himself professionally— has broken out in a rash of emphasis. Our first exposure this year was the quiet Sunday afternoon session that opened the AIChE meeting at White Sulphur Springs.

Woven into the main subject of professional registration of chemical engineers was the proposal from Dow Chemical (via the Texas Div.) that registration and licensing is a helpful step in the professional development of young engineers.

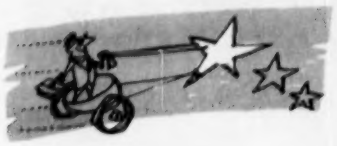
Dow recognizes this development by granting plus credits to the merit and salary reviews of those engineers who either have registered or have made an effort to become registered. The policy principle is that professional registration is a checkpoint on the path of professional development and therefore it should be given some sort of financial encouragement by management.

Which Came First?

During the discussion period, a sharp question from Syracuse, N. Y. may have ruined the sanctity of that afternoon in West Virginia for our friends from Freeport and Velasco.

The questioner wanted to know whether the young engineers at Dow were seeking to develop themselves professionally or to gain the salary increase that usually accompanied successful completion of the requirements.

Of course, the question couldn't be answered. Even by a Texan. The Syracusan loosened his tight grip on the micro-



phone and repossessed his seat, unsatisfied.

Fires Mixed Emotions

As an editor, we should have been keyed in right then and there to the kinds of mixed emotions that the subject of professional development can arouse.

But in all honesty, we must say that it wasn't until a meeting of the New Jersey Section of AIChE later in the Spring that we first awakened to significance.

The programmers gathered an excellent assortment of polished speakers on the professional development panel. Most clearly we remember something that F. J. Van Antwerpen, secretary of AIChE, brought out in the question-and-answer session. Apparently, chemical engineers are so aware of the necessity of being able to develop themselves professionally that they consider it a proper subject for collective action.

Under the chairmanship of Frank Reese, the professional development committee of AIChE is examining the possible impact of a program that would rate employers. A plan has been proposed whereby the professional development committee would be assigned the task of rating employers of chemical engineers and of publishing lists of approved employers (those who allow their engineers ample opportunity for professional development).

As "Van" cautioned at that Newark, N. J., meeting, this is a very involed proposal with many possible beneficial as well as dangerous side effects. It is a long way from implementation and needs much careful thought, discussion and committee work.

Our notebook from Newark contains a scribbled inscription about "Watch professional development—hot topic."

And Watch We Did

So we watched and we waited. But not for long. The yellow and blue program in our mailbox was for the annual meeting of the National Society of Professional Engineers. It announced "A Series of CONFERENCES . . . The Professional Development of Young Engineers . . . In Industry . . . In Private Practice . . . In Government . . . In Education . . . One will be of special interest to you. The Statler Hilton, Dallas, Tex. June 7, 1957"

Recognition and Programs

Kemp Anderson, chief of McGraw-Hill's recently relocated Southwestern news bureau in Dallas, covered for us. Kemp reports:

Discussion of the young engineer in industry developed around two points: (1) recognition—both community- and company-wise—for the engineer who stays strictly with the technical side of engineering as well as for the engineer who goes into management, and (2) programs essential both for development of the individual and the company.

Panelist Frank H. Hurley, manager, Management Education and College Relations, American Cyanamid, described the recognition problem as a Y-type plan. "It is clear to begin with that we must plan for two avenues of personnel development: managerial and professional. These avenues branch from a single broad street down which our younger, less experienced employees move at varying speeds, depending on their competence."

Hurley added, "In thinking about determining the objectives of a professional job, one inevitably comes to the conclusion that this involves a partnership between management and the professional worker. Job objectives must be related to the overall business objectives of the organization as determined by management. If they are not, the professional man will feel isolated and unsure of the significance of his work.

"His responsibility in determining his 'job objective' is actually more fundamental than that of management. For although the objectives of the business can and should be clearly known to both partners, only the professional man can know the ever-changing state of his science and art."

For Those in Private Practice

Four points were considered in the discussion of the young engineer who is employed in private practice:

- Professional development opportunities.
- Working conditions.
- Economic problems.
- Unionism.

However, discussion stressed the creation of the right atmosphere within an engineering organization. Nonphysical working conditions, challenging work, good communication with management and the feeling of being an active part of the company were stressed.

Experience vs. Economic Status

One of the panelists, Alex Van Pragg, Jr. suggested "economic problems concern young engineers perhaps more than any other problem or subject. Employees today seldom accept employment to gain experience at the expense of economic status. Young engineers are keeping themselves posted on salary levels and like items."

Van Praag was of the opinion that professional development opportunities are abundant in engineering offices both large and small. The only limitation, he said, is the willingness of the young engineer to accept the opportunities and to pursue them.

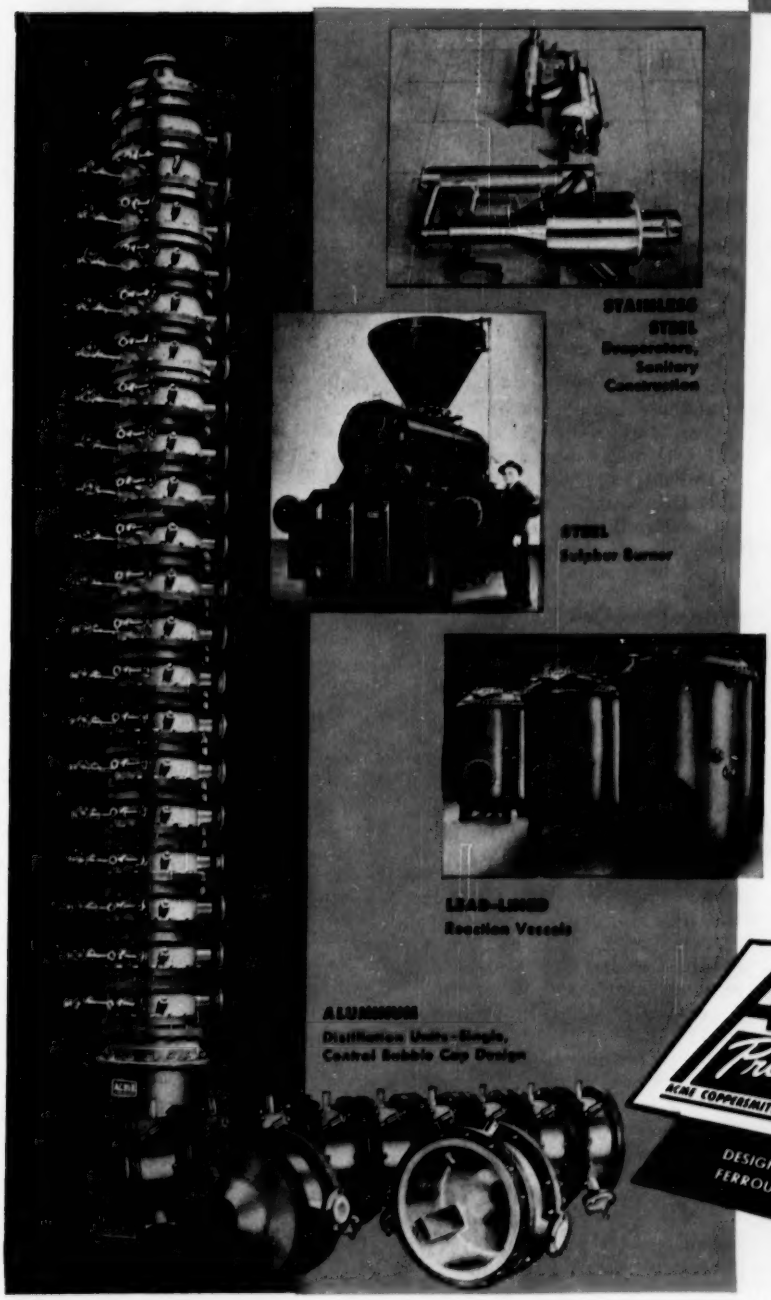
"The deterrent to such opportunities is a seemingly growing attitude on the part of young engineers — particularly applicants for engineering positions —to give the least service for the greatest compensation."

An Employee Speaks Up

Speaking from the employee point of view, Tom Lowe, Jr., stressed the point that the young engineer of today wants and expects professional recognition in his chosen field. "The young engineer," Lowe said, "has a definite desire to feel that he is making a necessary contribution and further that he is a part of a close-knit organization, thought of as an individual, a professional engineer and not a

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necessary evil that must be endured."

Professionalism vs. Unionism

It seems that no discussion of professional engineering can be entirely separated from the problems of engineering unionism.

Regarding unionism, Lowe said, "If employers and management will get their heads together with employees and work out the problems which exist between the two, unionization of engineers will experience an extremely sharp drop in popularity in the near future. It should be remembered at all times that only a very small minority of the engineers actually want to be represented by unions."

Government and Education

Discussion of the engineer in government and education stressed the fact that the state and federal governments and colleges must have something to offer in other attractions to compensate for a deficiency in pay.

Challenging opportunities which require a man to extend himself was offered by the panelists as one of the best ways to make up this deficiency.

Only Three Days Later

Only three days later, young engineers attending the ASME semi-annual meeting in San Francisco were being given some expert advice on how to hitch a wagon to a star. Their teachers: a team of top-flight engineers who have attained recognition in industry and education.

With Emil Mikity, CE's Western (San Francisco) editor on a swing through the Pacific Northwest, including the Seattle meeting of AIChE, we called in McGraw-Hill's news bureau in San Francisco. This report from Jenness Keene.

Aim for the Stars

Discussing the subject, "How Can a Young Engineer Develop Professionally?" the panel members agreed that an engineer must never be satisfied with mediocrity if he is to be a credit to himself and to his profession. The panel was divided into four parts:

• Professional experience, F. Wendell Beichley, regional engineering manager for Westinghouse Electric Corp., said a young engineer should make a plan for professional development, but keep it flexible enough for new ideas to get in.

• Professional knowledge. Smith de France, director of Ames Aeronautical Laboratory, Moffett Field, Calif., said an engineer today needs more advanced knowledge, and therefore more schooling, than ever before.

• Professional associations. Robert E. Newton, chairman of mechanical engineering at the U. S. Naval Postgraduate School, Monterey, Calif., urged the young engineer to start participating in associations at the college level and to continue throughout his career, in order to establish valuable contacts with others in his profession.

• Professional thinking. A. K. Oppenheim, Univ. of Calif., Berkeley, said that a new kind of "over-all thinking" is required of today's engineer.

Adopt a Fixed Plan

Without a fixed plan, Beichley told the group, a career may amount to nothing more than the passage of time.

"To avoid squandering his working years, an engineer should constantly evaluate, index and catalog his experience in the hope that it will help him develop judgment."

Beichley believes that a sensible mix of experience during the first 10 or 15 years of a career is valuable. This can be obtained in one of two ways: by moving from job to job (which is expensive for your employers); or by arranging to do various types of work all within one organization. He suggested these rules for a plan of professional development:

• Include in your working years some experience in motivating people.

• Be aware that your professional growth might lead to administration, and learn something from management's point of view. Remember that 34% of engineers eventually are promoted to high executive positions.

• Participate in extra-curricular activities such as public speaking and article writing.

• Interpret your experiences and apply them to all your activities.

• Keep your mind open, and change your attitudes with changing times. Call upon your past experience, but re-evaluate it in the light of present ideas and technology.

Organizations Can Help

Newton believes that professional organizations can help an engineer in:

1. Making the proper contacts necessary for personal advancement.

2. Learning from others in his profession.

3. Helping to advance his profession in the eyes of the public.

An engineer can't join professional associations too early, according to Newton. He advised the young engineer to join societies in school, then to make contacts with other engineers in his own firm, and most important, to join an engineering professional society, read its publications, participate in section meetings and attend its meetings.

"The technical sessions are an essential element of a national meeting, but the most valuable ideas come out in smaller discussions. However, don't neglect the technical sessions, and join the discussions when they interest you. Offer a paper of your own. It's not too difficult and it's a rewarding experience."

Then, Brainstorming Questions

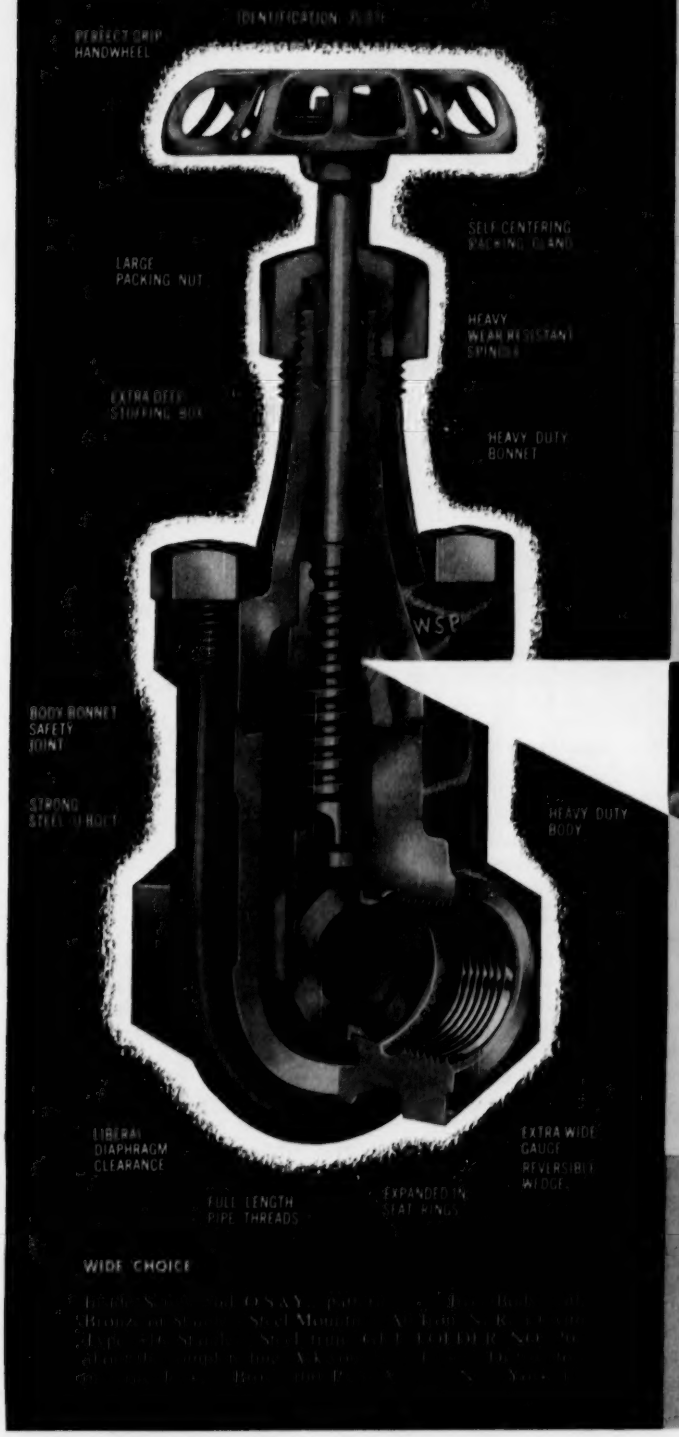
That the engineers in the audience took their lesson in professional development seriously was obvious from the brainstorming quality of their questions.

A heated discussion, mostly ideological, developed when one engineer asked if salesmanship was involved in getting ahead. Oppenheim took the view that an engineer should realize that his rate of advancement will not be as fast as in other fields; that

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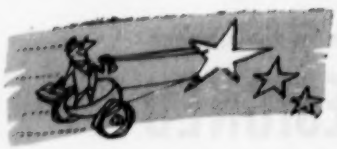
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the engineer should have humility and be satisfied with the creativity of his work.

"Personally, I would prefer to be considered an underpaid genius than an overpaid moron. . . . I deplore the too-good salesmen in our classes. They stop being productive. We have a duty to our profession that comes above salesmanship."

Question: How do you become a creative engineer?

Oppenheim: You don't learn creativity. It's a gift of God. But we can inform the creators about the tools they can use.

de France: The ability to be a creative engineer—a "screwball"—is inherited. But we can teach human engineering. The professor can inspire and bring out original thinking.

Question: Isn't luck necessary for professional success?

Beichley: It has a lot to do with it, but even with luck, you still have to have the rest of the qualifications we've talked about. It's true that you can be stopped if the right people aren't there at the right time. Right now there is a new trend toward management development, where a constant watch is kept over performance of employees. One day this may be directed to technical development, too.

Newton: Arrange to be in the right places at least a fair percentage of the time. If you think your abilities aren't being recognized, be frank about it. Talk to your supervisor. He has problems; maybe he doesn't realize what the situation is.

Beichley: If you talk to your supervisor soon enough, you may work out a plan of action for going on ahead.

de France: The question is, do we recognize it when fortune presents itself to us?

Another question: How long does it take to develop professionally to a level of recognition?

de France: That depends on the individual. With six or seven years' education, some can do it in ten years. With four years of college, they might make it in 12 to 15 years. We have a special plan for "screwballs" who often are outstanding men who can work on a team. We make them specialists with no administrative duties, and they progress financially as fast as the others.

Of Continuing Interest

And so, as the sun fades slowly in the west, we must take leave of beautiful San Francisco, but the question of what the young engineer can do to develop himself professionally continues to burn bright on the next horizon.

ASME has announced an eastern version of this same type of panel discussion to be held in Hartford, Conn. on September 23rd. The New York Section of AIChE will have a professional engineering panel to thrash out some professional development problems when it gathers for the all-day symposium scheduled at the Hotel Statler in New York City on October 22nd.

And, although final details have not yet been announced, AIChE will sponsor a professional development session at the annual meeting in Chicago.

Why all the talk?

Because more and more young engineers are asking the same question: How can I hitch *my* wagon to a star?

Next Month: What Pay for Special Training?

If your employer sent you to a special school for a full year, would you expect a higher salary than other engineers with the same background and experience? You probably would. If you are a licensed professional engineer do you expect to earn more than engineers who are not licensed? Yes, you probably do. But it ain't necessarily so. Join us next month as You & Your Job looks at some just released salary figures for engineers with special training. Perhaps you already know what these figures indicate and have already resigned yourself to the apparent paradox. If not, we offer a possible rude awakening.

GRADUATE WORK

. . . *Starts this Fall*

Chairman Al Cooper of the chemical engineering department at Pratt Institute (Brooklyn, N. Y.) informs us, "we are starting an extensive graduate program beginning this September."

Advanced work for the master's degree is being offered in these three general areas:

- Chemical engineering unit operations.
- Physical metallurgy and solid-state science.
- Nuclear technology, radiochemistry and reactor theory.

In addition, advanced courses will be offered in mathematics and the engineering sciences.

To assist in both the undergraduate and new graduate program at Pratt, two new faculty members will join the staff. They are: Harold D. Allen, formerly of Cornell Univ.; and D. J. Yuengling, formerly associated with the Oak Ridge Institute.

DO YOU OWN

. . . *Your Knowledge?*

Can an employee who has been confidentially trained by a company and made fully aware of its trade secrets be prevented from disclosing a half million dollars worth of those secrets to a competitor who hired him away?

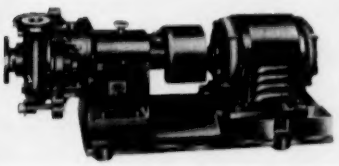
According to the *Wall Street Journal*, this is what Christensen Diamond Products Co. is going to try and find out in Federal District Court, Salt Lake City.

The firm filed an injunction suit and obtained a temporary restraining order against Varel Mfg. Co., Dallas, Tex., and Royal G. Stookey, Christensen's plant manager in Oklahoma City, until Varel hired him away. A court order now prevents Stookey from disclosing to his new employer any of the "formulas, processes, equipment and 'valuable' trade secrets. It also bans Varel Mfg. from "learning or obtaining" the trade secrets.

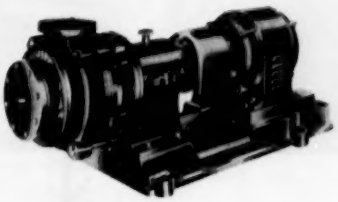
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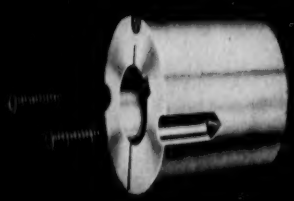
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PEOPLE . . .

TECHNICAL BOOKSHELF

J. B. BACON

Petrochemicals

THE CHEMISTRY OF PETROCHEMICALS. By Melvin J. Astle. Reinhold Publishing Corp., New York. 267 pages. $6.50.

As one might expect, this book is more than pure chemistry, and that's what makes it of value to chemical engineers.

Practical author Astle makes a point of embellishing pure chemistry with reaction conditions, yields, types of catalysts, special equipment needed and other such useful information. And it would take a fast man many weeks to gather the extensive list of literature references included in the volume.

In lucid, readable style, Astle rounds up most of what's worth knowing about commercial syntheses and reactions of paraffins, olefins, diolefins, acetylene, naphthenes, aromatics, alcohols, aldehydes and ketones, acids, anhydrides and esters and amines and nitriles, squeezing in a chapter on polymerization and alkylation.

As is usually true of the small book with a broad reach, it won't satisfy the expert in his facet of the field, but for the student or the engineer who wants to know more, it's a good buy.—JBB

Statistics

STATISTICAL METHODS IN RESEARCH AND PRODUCTION (With Special Reference to the Chemical Industry). 3rd ed. Edited by Owen L. Davies. Oliver and Boyd. 396 pages. 45s.

Reviewed by Leon Cooper.

This third edition of what is now a standard text in the field of statistical applications maintains the excellence of previous editions and includes much new and valuable material. There is an added chapter on the relationship between variables as well as a more extensive treatment of other topics in previous editions.

"Statistical Methods in Research and Production" is particularly valuable and useful to workers in the chemical field for several reasons. It's not intended as a text on mathematical statistics but rather as a handbook and guide to the application of statistics. The authors have used only elementary mathematical techniques and material is therefore completely accessible to chemists and chemical engineers. Style is admirably lucid throughout. Since the book was written for Imperial Chemical Industries, all the examples are those which arise in chemical industry practice. This affords an excellent means for practicing chemists and chemical engineers to see the application of statistical methods in terms of very meaningful examples.

The first chapter is a brief though adequate discussion of the nature and scope of statistical methods. The authors state their intent clearly. "To bring together under one cover those methods of statistical analysis which are most likely to be of use in the Chemical Industry."

The next two chapters concern variation and its description by frequency distribution (including a good discussion of the concept of a normal distribution), various averages and measures of dispersion (classified as measures of location, dispersion, skewness, and kurtosis).

Chapter four is a discussion of the method of calculation of confidence limits, with several well chosen examples given. The authors state the reasons for their preference for using confidence limits rather than tests of significance, their experience pointing to the greater utility of the former.

The next chapter is a discussion of an extremely important practical problem—choosing the number of observations to be made from which a decision can be made which will minimize financial risk. Three basic situations are described: Prior distribution and cost known, prior





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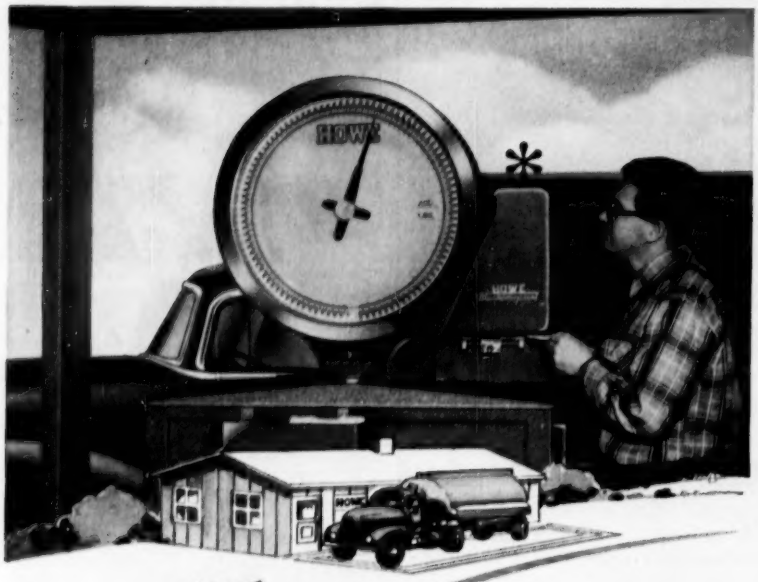
- Flexidyne Dry Fluid Drives and Couplings. Bulletin A-640-A.
- Roller Bearings. Load ratings, dimensions, etc. Bulletin A-638.
- Sealed-Life V-Belts. Complete data and sizes. Bulletin A-606-A.

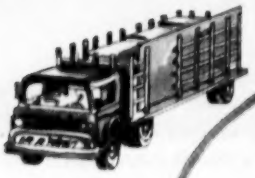
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distribution unknown and cost known, and finally both prior distribution and costs unknown.

There follows an excellent treatment of analysis of variance, the technique by which differences resulting from sampling variation may be separated from differences resulting from the test itself. The examples here are particularly good.

Chapter seven is concerned with the study of linear functional relationships between variables and the concepts of correlation and linear regression. This chapter is important and contains several excellent examples.

The next chapter treats multiple and curvilinear regression, and there is much valuable information in these pages to people involved in analyzing chemical plant data.

Chapter nine is a discussion of the analysis of frequency data, i.e., the numbers of times certain events have occured. The use of contingency tables is discussed and examples given.

The last two chapters are devoted to the important field of quality control and constitute a good introduction to this area of statistical application.

Acid- and Base-Formers

COMPREHENSIVE INORGANIC CHEMISTRY, Vol. VI. Edited by M. C. Sneed and R. C. Brasted. D. Van Nostrand Co., Princeton, N. J. 234 pages. $6.

Reviewed by K. A. Kobe.

The alkali metals and hydrogen, which are discussed in Volume VI, are alike in that they have one electron in the outer shell which can be removed readily to form a univalent positive ion. After that, the similarity ceases and Volume VI must be consulted for the differences between hydrogen and the alkali metals, and among the alkali metals themselves.

The section on the alkali metal, which occupies the major part of the book (182 pages), was written by Prof. John F. Suttle of the University of New Mexico Graduate Center at Los Alamos. The chemistry of the alkali metal compounds is discussed on the

basis of the anions involved, since the chemistry of these compounds is dominated by the anions. Differences due to the cations are pointed out. Preparation of the metals and various compounds is discussed briefly.

This section represents a considerable change from previous volumes by the introduction of numerous phase diagrams, charts, flowsheets and tables. Much more information and data are given in less space in this way. Statistics should be up-to-date, there is no use giving caustic soda consumption from 1929-1948 and ignoring the last ten years. *Chemical Engineering* still publishes the data. With tonnage quantities of mixed rubidium and cesium salts available as a byproduct from lithium production, industrial uses for these previously scarce elements should expand.

The shorter section (40 pages) on hydrogen was prepared by coeditor R. C. Brasted. After discussing the ortho-para isomers of hydrogen, the chapter follows the usual pattern of preparation, physical properties, and chemical properties. Numerous methods of preparation, both industrial and laboratory, are given. Hydrides are discussed in some detail. Deuterium and tritium are treated adequately.

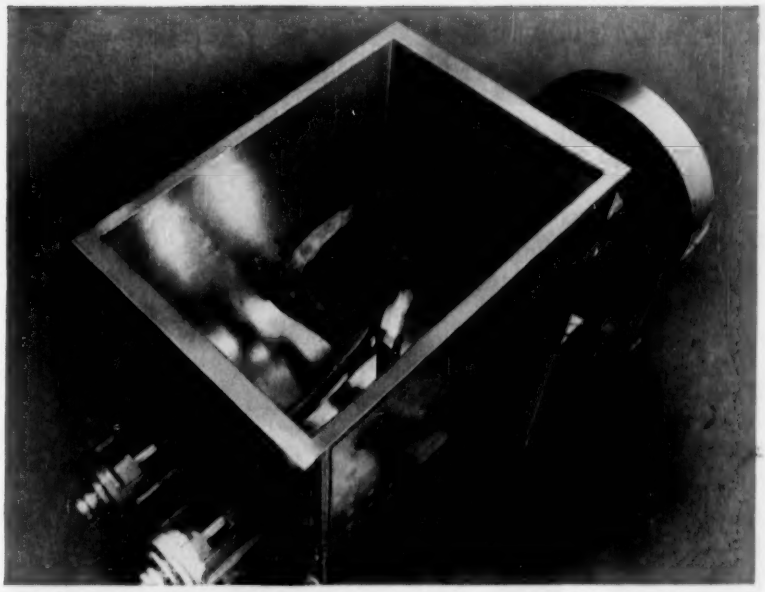
Chromatography

GAS CHROMATOGRAPHY. By A. I. M. Keulemans, edited by C. G. Verver. Reinhold Publishing Corp, New York. 217 pages. $7.50.

FUNDAMENTALS OF CHROMATOGRAPHY. By H. G. Cassidy. (TECHNIQUE OF ORGANIC CHEMISTRY, Vol. 10. Edited by A. Weissburger.) Interscience Publishers, Inc., New York. 477 pages. $9.75.

Reviewed by F. C. Nachod.

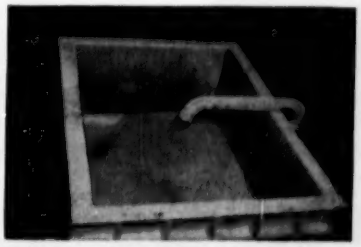
GAS CHROMATOGRAPHY. Claude Bernard made the statement that "a good technique sometimes renders more service to science than the elaboration of highly theoretical speculations". Gas chromatography, also called vapor phase chromatography or



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DAY 350 gal. mixer operating at East Texas Pulp and Paper Co. Note soft clay dispersion of high solids batch.

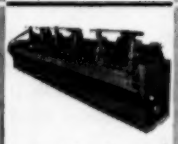
Like all DAY equipment, these mixers are engineered and built for extra long service under the toughest conditions. Available in 5, 20, 200, 350, 550, 660 and 1000 gallon pasting capacities.

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DENVER Steel-Head BALL MILL		3'x 2' to 8'x 20'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER Automatic SAMPLERS		16" to 60" Cutter Travel	Heavy duty units, extra rigid track and ball bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid and corrosive service. Wet and dry cutters. Central Control Panel for multiple samplers. Bulletin No. S1-B4.
DENVER Forced-Feed JAW CRUSHER		2½"x 3½" to 36"x 48"	Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavy-duty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C1-B12.
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DENVER Disc FILTER		1 Disc, 2' to 12 Disc, 9'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. FG-B1.
DENVER "Sub-A" FLOTATION		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
DENVER Wilfley Concentration TABLES		5 to 150 T/24 Hrs.	A mechanically operated, longitudinally reciprocating table consisting of a deck having a plane surface partly riffled and a tilting device. It separates materials into bands and handles the coarsest sands with excellent results. Ideal for separation of groups of particles having a similar range of specific gravities. Write for Bulletin No. T1-B3.
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gas-liquid partition chromatography, is an example of such a technique which has had a spectacular impact on practically all aspects of chemistry since its announcement by Martin and James in 1952.

The Dutch Shell group has been the trail-blazer in Europe in designing suitable equipment and in pointing out the usefulness of this method in analytical problems in the petroleum chemistry. Dr. Keulemans as their spokesman has written a lucid text dealing with all theoretical and practical aspects which will undoubtedly find a wide and appreciative audience among all chemists and chemical engineers confronted with analytical problems of gaseous or liquid mixtures.

FUNDAMENTALS OF CHROMATOGRAPHY. Volume V of the "Technique Series" which appeared in 1951, entitled "Adsorption and Chromatography", written by Dr. Cassidy, has now been superseded by an entirely new treatise, predicated by the tremendous growth of the field.

The author has used a new approach in stressing the principle of chromatography. After defining the terminology he has written a lucid chapter (III) on molecule-substrate interactions. Theory is extensively treated and the various types of partition and adsorption methods are covered exhaustively. A list of over 1,000 references is appended which makes the book very valuable for the reader.

Author and editor deserve full acclaim for an up-to-date treatise on chromatography which measures up to the high standards of the "Technique" series.

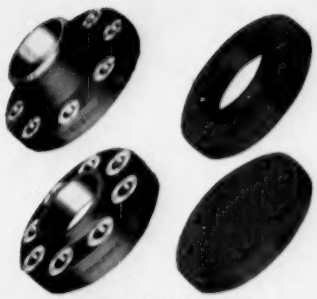
BRIEFLY NOTED

RECOMMENDED PRACTICE FOR REPAIR WELDING AND FABRICATION WELDING OF STEEL CASTINGS. 1957. 52 *pp. Tempil Corp.*, 132 *W. 22 St., New York* 11, *N. Y. Free. Also available from Steel Founders' Society of America*, 50¢. First revision of the manual since 1951, containing considerable amount of new information. Manual is result of research project conducted by Battelle Memorial Institute.

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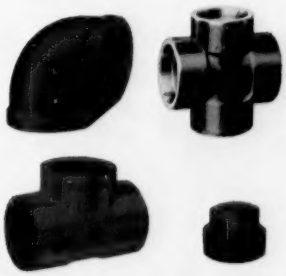
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HOW TO SELECT WATER-CONDITIONING EQUIPMENT (NO. 4 OF A SERIES)

Filters

Basic filter parts include: the outside container, the bed of filter medium and the distribution and collection systems to provide a uniform flow through all parts of the bed. Flow rates average 2 to 3 gallons per minute per sq. ft. of bed area.

Filter beds are cleaned periodically by reversing the flow and increasing it to about 10 to 20 gpm per sq. ft. (backwashing). This lifts and swirls the sand, loosening the dirt and flushing it to waste.

Rotary surface washers with high-velocity water jets may be used to help break up the layer of dirt on top of the bed.

After backwashing, the first water through the filter (rinse water) also picks up some dirt and is run to waste.

A "multiport valve" replaces 5 individual valves and reduces the number of valve manipulations for cleaning a filter from 10 to 3. It also indicates the cycle in progress and ensures proper sequence. Operation can be made completely automatic with hydraulically- or motor-operated valves controlled by meters, timers and float switches.

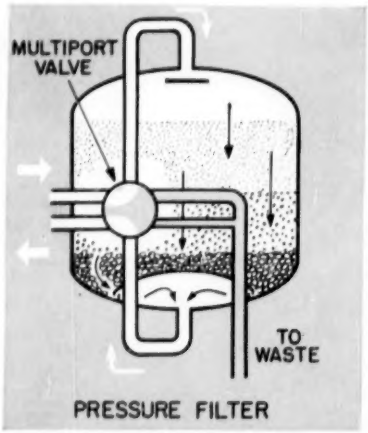
SAND FILTERS for removing dirt, precipitates, suspended solids

Sand filters simply "strain" the water as it flows downward through the filter bed. It is probably the oldest and most widely used method of water treatment.

Gravity filters. Practically all large public water-supply plants include a series of gravity filters made of concrete for permanence and low maintenance cost. Sizes run up to 400 or 500 sq. ft. for each filter.

Chief difference among concrete gravity filters is the method of water collection under the filter bed. The false bottom system provides uniform collection but requires about 2 ft. extra filter height and is highest in cost. Header-lateral collection systems of steel pipe are lowest in cost but do not provide perfectly uniform collection and can corrode. There are also patented systems such as Permutit's *Monocrete*® system which uses collapsible forms for casting lateral ducts in the concrete itself. *Monocrete* ducts are oversize for uniform collection and are corrosion-free since no metal is used. The cost is less than for false-bottom construction.

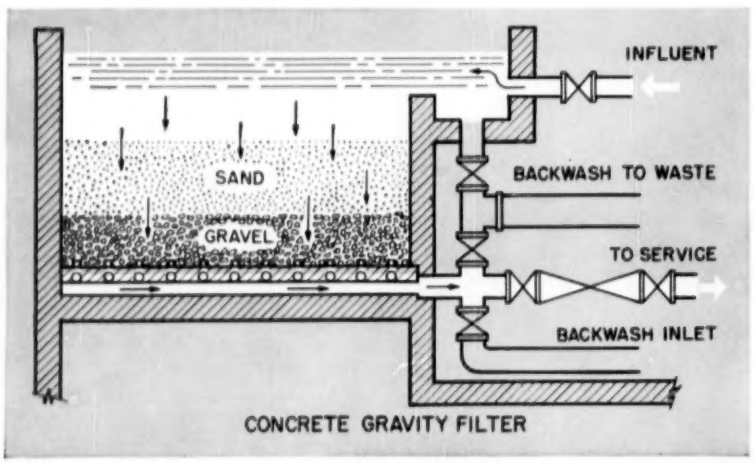
Steel-tank gravity filters cost less than concrete in small and medium sizes and are generally used in industrial plants. Wood-tank filters have low maintenance cost, but they are not practical for large sizes and not as attractive as painted metal. They are now used primarily where there is a metal shortage.



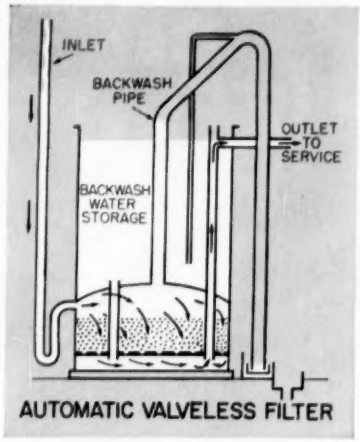
PRESSURE FILTER

Pressure filters deliver an effluent under pressure, usually under 100 psi, to eliminate repumping. Since no water depth is required over the bed to provide pressure, these filters are smaller and lower in cost than gravity filters of the same capacity.

Vertical pressure filters are available to 12 ft. diam. with approx. 113 sq. ft. of bed area. Horizontal pressure filters provide large filter-bed areas, up to 200 sq. ft., at lowest tank cost but may not maintain as uniform bed conditions as vertical type.



CONCRETE GRAVITY FILTER



AUTOMATIC VALVELESS FILTER

Automatic Valveless Filters (gravity type) are a new Permutit development. They greatly reduce filter cost because they use no valves or flow controllers. They provide completely automatic, foolproof self-operation yet actually cost less than conventional manually-operated gravity filters. Sizes up to 12' diam. available.

When the suspended matter removed by the filter bed causes the pressure loss to reach a predetermined figure, backwashing starts automatically. At end of backwash, flow reverses automatically, and the backwash storage compartment is then filled with a brief rinse plus filtered water. Filtered water then passes to service through a separate outlet.

FILTER MEDIA for removing oil, bad tastes, odors, etc.

Graded anthracite coal. Used in place of sand to minimize pick-up of silica following hot-process softening of boiler feedwater or for removal of oil from steam condensate.

Activated Carbon (Carbo-Dur®). Absorbs excess chlorine and dissolved elements caused by decayed vegetation or algae that affect taste and odor. Carbon filters or "purifiers" are backwashed to remove suspended matter picked up by the filter.

Calcium Carbonate (Neutralite) raises the pH of low-pH, corrosive water at the same time that it filters.

Manganese zeolite oxidizes and removes moderate amounts of iron and manganese, also hydrogen sulphide, chief cause of "rotten egg" odor and sulphur taste. It is regenerated with potassium permanganate.

For information on filters or other water-conditioning equipment, write: The Permutit Company, Dept. CE-10, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

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Water Conditioning
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UNDER PRACTICAL CONDITIONS. 380 *pp. DECHEMA Deutsche Gesellschaft fuer chemisches Apparatewesen. Frankfurt (Main), Germany. Members: DM* 33.75; *non-members: DM* 42.15. Contains verbatim reports of 19 lectures delivered at 1956 annual meeting of Dechema.

TIN RESEARCH. 1932-1957. *Tin Research Institute, Inc.,* 492 *W. Sixth Ave., Columbus* 1, *Ohio. Free.* Presents short synopsis of some new uses of tin.

ZINC OXIDE REDISCOVERED. 100 *pp. New Jersey Zinc Co.,* 160 *Front St., New York* 38, *N. Y.* $3. Comprehensive review of worldwide research on zinc oxide. Gives structure properties, solid-state reactions.

CHEMICAL RESISTANCE OF PLASTICS. 475 *pp. Office of Technical Services, U. S. Department of Commerce, Washington* 25, *D. C. Order PB* 121133. $9. Gives data from tests of 15 chemicals (such as acids, an alcohol, a mercaptan, two fuel oils) on 25 thermoplastic and thermosetting resins.

MORE NEW BOOKS

SOUTHWEST RESOURCES HANDBOOK. Southwest Research Institute, San Antonio, Tex. Subscription price: $250 first year, $100 a year thereafter.

EXPERIMENTAL DESIGNS. By William G. Cochran and Gertrude M. Cox. Wiley. $10.50.

QUANTITATIVE ORGANIC ANALYSIS. By James S. Fritz and George S. Hammond. Wiley. $6.50.

COMBUSTION RESEARCHES AND REVIEWS. Published for Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization. Interscience. $5.60.

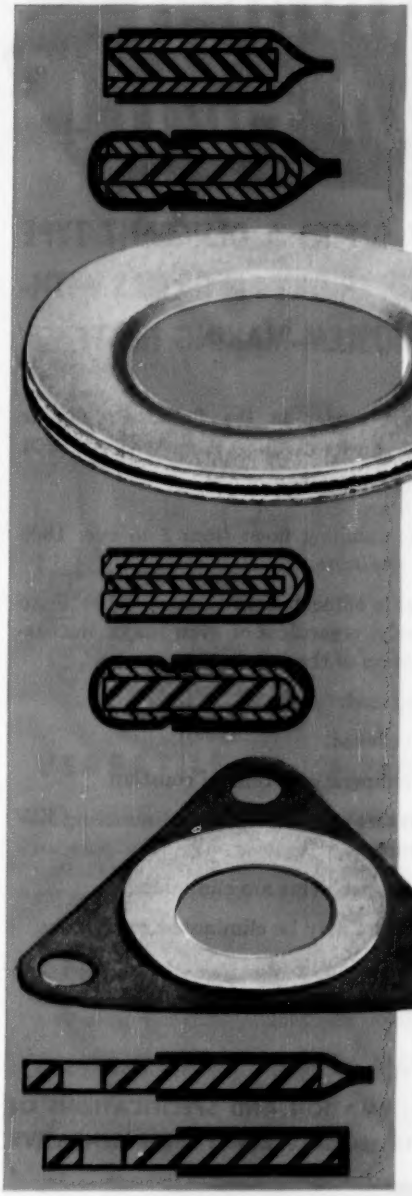
ELECTROCHEMICAL THERMODYNAMICS AND KINETICS. Proceedings of the Seventh Meeting of the International Committee. Butterworths Scientific Publications. 84s. plus 1s. 6d.

ADVANCES IN PEST CONTROL RESEARCH, Vol. 1. Edited by R. L. Metcalf. Interscience. $11.

DUTCH CHEMICALS AND PHARMACEUTICALS. Vereniging van de Nederlandse Chemische Industrie, The Hague. D. Fl. 16.50.

Chemiseal® Gaskets

. . . with protecting Jackets of du Pont TEFLON, are impervious to all known chemicals*. They are made with a variety of filler constructions to suit every connection problem—every pipe and nozzle material requirement—whether glass, ceramics, stainless, Karbate, Haveg, glass-lined steel, etc. That is why Garlock 8764 Chemiseal Gaskets have become the standard choice of the process industries.



Illustrated at left is the standard Chemiseal slit-envelope Ring type Gasket designed to fit inside the bolt circle of flanges drilled to 125 lb. standards and made for all standard pipe sizes up to 10" I.D. Stocked for all Pfandler and Glascote standard nozzle sizes from 1½" to 10" I.D.

Also available as shown with double jacket protecting O.D. as well as I.D. against corrosion.

Illustrated at left is Chemiseal formed-shield Ring type Gasket for large diameter glass-lined steel or special material nozzles and irregular shaped openings. Also available as shown with double formed-shield protecting both O.D. and I.D.

Illustrated at left are Chemiseal Gaskets with full face filler with bolt holes, for standard Corning conical flanges. These gaskets seal with unusually low bolt loads. Shown are both slit-envelope and milled-envelope types.

Milled-envelope type fits flush with the pipe I.D. and provides minimum impedance to flow. This type Jacket is supplied either with full face filler or with filler to fit inside bolt circle on standard 125 lb. flanges.

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- 18 models available, handling flows from 2 to over 1800 standard cubic feet a minute.
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PEOPLE . . .

MEET YOUR



Edward B. Nitchie

REPORT: COST REDUCTION. PAGE 233.

During his career of management and engineering—mainly in the chemical, food and drug industries—Edward B. Nitchie developed an increasing enthusiasm for the cost saving potentials of good industrial engineering, cost accounting and other scientific techniques.

A few years ago, he deserted the management field to do consulting work in the various fields which led to cost reduction.

All told Nitchie has spent about 26 years in management, administration, consulting, engineering and research. Right now, he's on the staff of Ernst & Ernst, a large management consulting firm, in their management services division.

Other work experience includes the following posts: assistant works manager at American Cyanamid's Linden, N. J., operations; superintendent in food processing for the Glidden Co., Elmhurst, N. Y., manager of operations in manufacturing for Basic Refractories, Inc., works manager at Cutter Laboratories; and supervisor in processing at Proctor & Gamble.

Nitchie graduated from Yale in 1931 with a B. S. in industrial engineering.

In his Summit, N. J., home, you'll find his wife, a son of junior high school age, and his two daughters—one of whom has just graduated in economics from Vassar.

Time spent traveling on con-

AUTHORS

M. A. GIBBONS

sulting asignments has left little opportunity for following up hobbies. Fishing and model railroad building, with his son, plus gardening and "do-it-yourself" projects around the house fill up what spare time there is on weekends. Photography—once an avid interest—has dwindled as a pastime to occasional pictures of the family.



Rowland W. Flournoy

ALUMINUM VARIETY SPURS USE IN HEAT EXCHANGERS. PAGE 318.

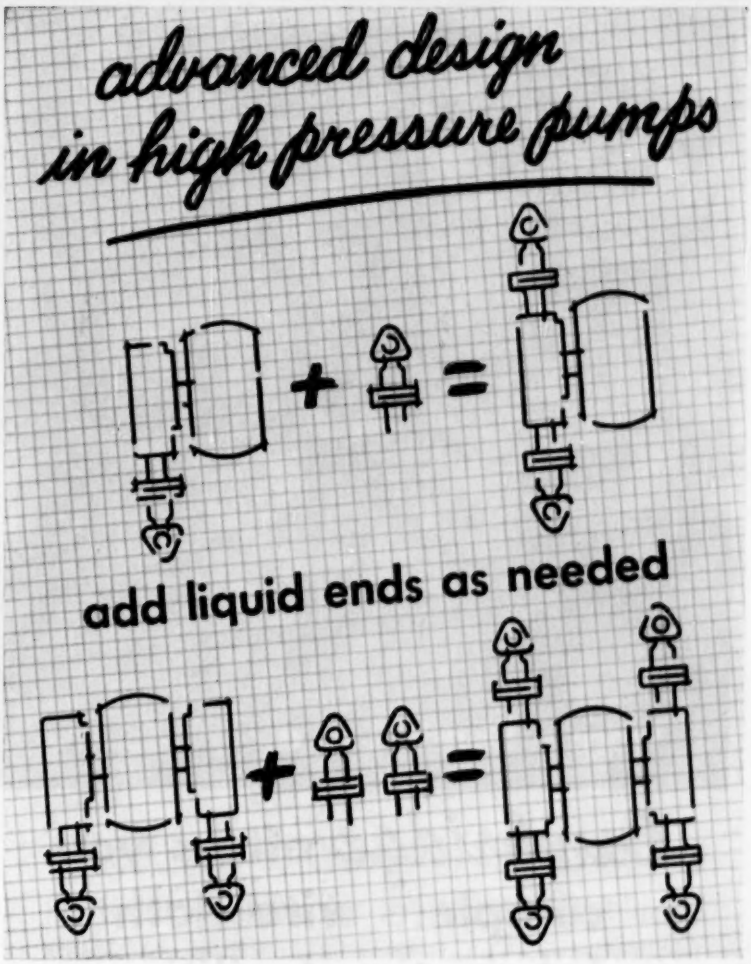
Reynolds Metals' Rowland W. Flournoy is chief chemical engineer in the engineering services department, in Louisville, Ky.

Previously, Flournoy served with the Corn Products Refining Co. as staff assistant and section leader in process engineering.

From 1942 to 1945, he was employed by Spencer Chemical Co. as technical superintendent and chief chemist. Before that time, he worked the Colgate Palmolive Peet Co.

After graduating from Kansas State College in 1935, with a B. S. in chemical engineering, Flournoy stayed on at the school for another year. He was a member of Sigma Tau and Phi Lambda Upsilon honorary fraternities and also completed some 24 hours toward his master's degree.

Flournoy is a member of the American Society for Metals and, in 1955, served on the so-



VERSATILE . . . FOR PRESENT AND FUTURE NEEDS

FRAMES of Philadelphia High Pressure Pumps are designed for ease in compounding any simplex or duplex pump. Multiple units avoid large piston areas vs. high pressure. Obtain high capacities with reduced horsepower requirements.

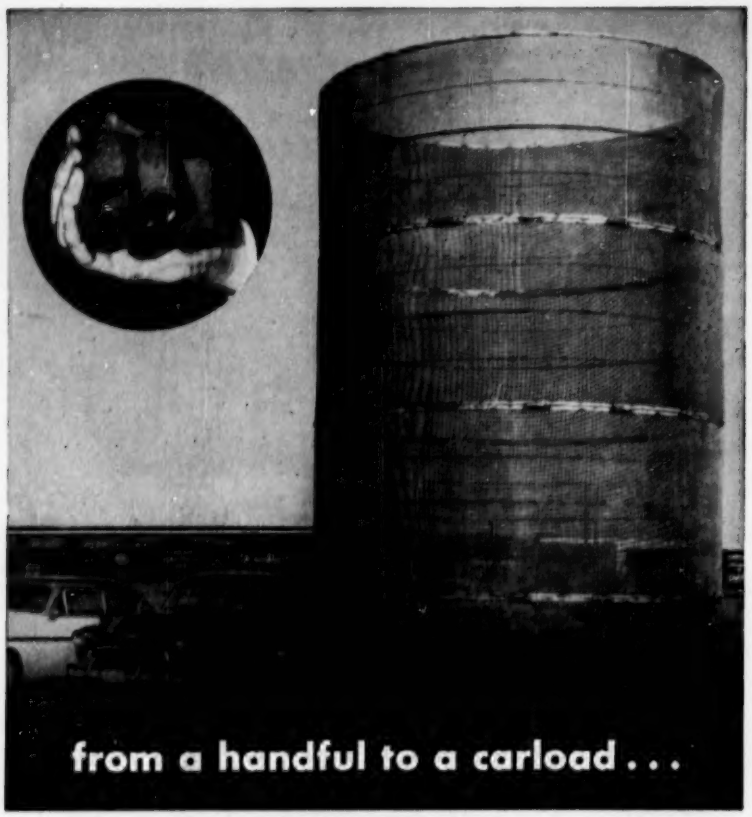
RUGGEDNESS, ample proportions and sound mechanical and hydraulic engineering permit these pumps to take high pressures in their stride—to stand up in hard industrial service with a minimum of maintenance and down time.

WIDE CAPACITY RANGE—Pump selection charts (Catalog HP-1254) show range from minimum of 30 cc per hour (smallest simplex) to maximum of 1648 g.p.h. (largest quadruplex). Write for your copy of this catalog.

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AUTHORS . . .

ciety's committee on stainless steel in chemical uses. He is also a member of the National Ass'n Corrosion of Engineers and served as chairman of the organization's Chicago section from 1955 to 1956. He is chairman of the North-Central region this year.

Hobbies include advanced electronic equipment and watch making.



Robert K. Bond

DESIGNING THE GILSONITE PIPELINE. PAGE 249.

Ever since Standard Oil of California got its gilsonite project under way in 1954, Robert Bond has had a hand in practically all phases of its development.

Bond was responsible for the project economics and for the preliminary design of the unit as well. What's more, he helped develop mining methods and equipment, had a hand in experimental work with the ore cutting machines and assisted in the design of the pipeline and filter plant.

Nearly all of Bond's professional career has been concerned with pipeline design and development. From 1948 through 1953 he worked on crude oil and oil products pipeline systems while employed on jobs with Salt Lake Pipeline Co. (subsidiary of Standard Oil of Calif.). One assignment, during this period, involved the design of a 330 mile oil products line between Salt Lake City and Boise, Idaho. Another was the design of a pipeline between Pasco, Wash., and Spokane.

Bond is a mechanical engineering graduate of the University of California, class of 1940.

He served in the Navy from 1943 until 1946 with the Civil Engineer Corps.

Though he claims to have no outstanding hobbies, he puts the fine recreational opportunities of California to good use; now and then, you'll find him boating in San Francisco Bay or hiking in the Sierras.

The Bonds and their three children live in Sausalito, Calif.



John H. Born, Jr.

MAINTENANCE OF DOWTHERM VAPORIZERS. PAGE 279.

As a member of Foster Wheeler's service department, John Born has had a good deal of contact with a number of firms on vaporizer maintenance problems.

His duties as a service engineer entailed quite a bit of trouble shooting. At every turn, he gleaned valuable practical operating information. And, from the number of times that he was questioned about the same operating difficulties, he realized that it would be well to get some of his ideas for solving these difficulties into print. This conviction led to the current article.

At the present time, Author Born is also engaged in graduate work at Brooklyn Poly. He earned a B. S. in chemical engineering from the school in 1948.

In addition to his membership in the AIChE, Born assisted in arranging a series of lectures for the New York section, on the computer as applied to the chemical industry. He is a professional engineer registered in the State of New York.

Spare time hobbies include reading, boating, and home movies.

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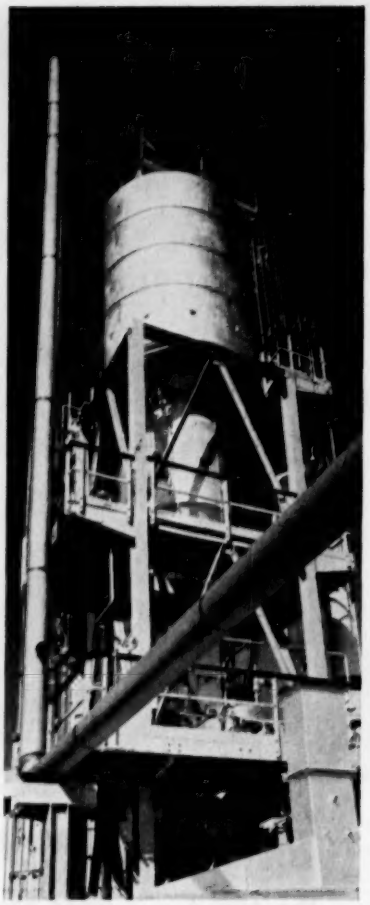
THE HILLIARD *Corporation*

160 WEST FOURTH ST. ELMIRA, N.Y.

IN CANADA: Upton-Broadeen-James Ltd., 890 Yonge St., Toronto; 8760 Verville St., Montreal

This SWECO-built stainless-steel catalyst activator operates at red heat in producing polyethylene for Celanese Corporation of America.

High-Level Service for Low-Pressure Plastics



SWECO process equipment helped Celanese Corporation clear the first hurdle in the high-density polyethylene race.

Exacting, high-temperature service for the hottest race in the plastics industry. That's what Celanese Corporation of America had to have to compete with other major chemical companies bidding for leadership in the production of new high-density polyethylene.

SWECO's Manufacturing Division built the stainless-steel catalyst activator and the shell and tube heat exchangers that helped Celanese get into the running. The Celanese Houston (Texas) plant, completed last February by C. F. Braun & Co., Alhambra, Calif., is pouring out spaghetti-like streams of polyethylene at the rate of 100,000 lb. a day.

Operates at red heat

The SWECO-built catalyst activator, designed for red heat operation, is used to activate catalyst for the low-pressure plastic. The new polyethylene retains its strength at the boiling point of water, is stronger and more resistant to heat than polyethylene of low-density, high-pressure manufacture.

Experience: 40 years

The Celanese project is another example of how SWECO – with more than 40 years of experience – serves the process industries...through the design and manufacture of *process equipment* such as heat exchangers, pressure vessels, steam jet ejectors and surface condensers...and through *engineering and construction services* and a complete line of *vibrating screen separators.*

If your processing needs are related to the exacting techniques and developments of the chemical industry or petroleum refining, write today for complete information on SWECO process equipment. Ask for Brochure M-6-32.

SWECO

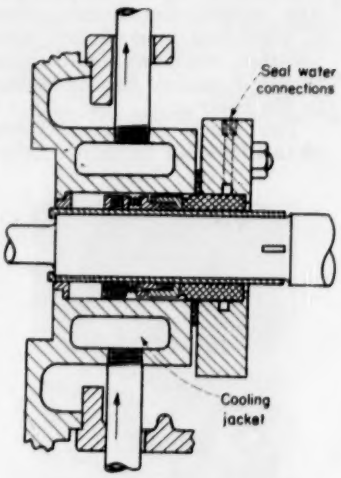
Southwestern Engineering Company

4800 Santa Fe Ave., Los Angeles 58, Calif.

Engineers & Constructors...Manufacturers

PEOPLE . . .

LETTERS:



Pro: Hot Pump Seals

Sir:

I thought Mr. Tracy's article in your April issue on mechanical pump seals (pp. 239-254) was very well done.

He handled high-temperature applications from a circulation concept. In contrast, we have successfully handled high-temperature liquids (e.g., Dowtherm up to 750 F. and high-temperature hot water) with the noncirculation approach for several years.

The conventional system described by Tracy is based upon circulation from the hot discharge of the pump back into the stuffing box, from where it re-enters the pump. A heat exchanger is placed in the circulation line to lower the temperature to limits satisfactory to mechanical seal materials. This has the disadvantage of requiring auxiliary equipment and of wasting power by recirculation.

Based on our testing several years ago at Purdue University, we found that we could purposely dead-end the seal chamber. As compared with reintroducing additional Btu.'s through recirculation, we have very little heat content to remove. We accomplish this easily by a water jacket around the stuffing box, and for further in-

PRO & CON

C. H. CHILTON

surance we water-cool a channel around the stationary seal ring in the gland itself (*see cut.*)

Our basic seal designs on this service have been Durametallic, but other seal manufacturers have recently adapted our system to other makes of pumps. However, shaft stiffness, proper design to minimize circulation of the hot pump liquid and proper proportioning of stuffing-box length and water-jacket area must be provided. Our system uses completely conventional seal materials and designs, and we have no difficulty at 750 F. on continuous duty.

Our system would be applicable only to clear hot liquids and would not be satisfactory for slurries.

R. D. NORTON
Dean Brothers Pumps Inc.
New York, N. Y.

New Conductivity Data

Sir:

Dr. O. B. Cecil of Monsanto Chemical Co. has informed me that there is a considerable divergence between the calculated thermal conductivity values for Aroclor 1248 as graphed in my February article (pp. 237-240) and the latest experimental data obtained by Monsanto. This difference has been resolved and we wish to note the appropriate corrections herein.

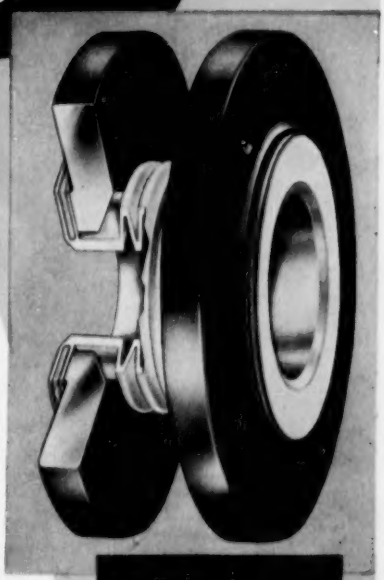
My estimated values were calculated with the Palmer equation (Eq. 2a), using Monsanto's partial-property and heat capacity data published in 1949. When the thermal conductivity of Aroclor 1248 is recalculated, using the latest Monsanto data for the dependent variables of the Palmer equation, the agreement with the better experimental data is quite reasonable.

Temp.	k
100 C.	0.0680
200 C.	0.0674
300 C.	0.0659

These values deviate from the latest Monsanto data by 15%, supporting both the experimental

Here's The Plain Truth About CHEMLON® Flexible Pipe Connectors

*"John Crane" fabricated from DuPont Teflon



When it is a question of chemical piping—where you need anti-corrosive protection, plus long life—Chemlon Connectors best meet the need. They are fabricated from the most chemically resistant material available, DuPont Teflon. The most destructive acids, corrosives and solvents have no deteriorating affect.*

Other important advantages are their long service-life, extreme flexing ability and wide temperature range from −65°F. to +350°F.

Chemlon flexible pipe connectors offer a definite plus value construction-wise. 1) They are made from Teflon specially fabricated for high and uniform density. 2) An exclusive manufacturing method assures uniform wall thickness throughout the convoluted area. 3) They are formed at full free length to reduce residual and working strain to an absolute minimum.

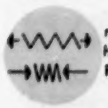


Vibration and Misalignment

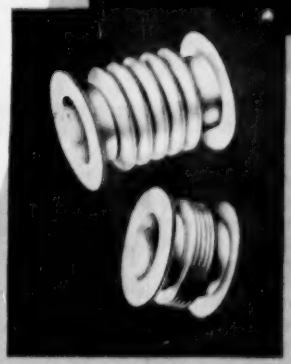


—severest vibration and misalignment conditions, such as pump to agitator or mixer to tank, will cause little deterioration or fatigue. Also, the Chemlon Flexible Pipe Connector serves as an acoustical as well as a mechanical dampener.

Expansion and Contraction



—continuous flexing over a wide range of temperature conditions has little affect on Chemlon Flexible Pipe Connectors.



Chemlon Flexible Pipe Connectors handle pressures to 75 psi., dependent on size. They can be supplied to fit any pipe size from ½" to 12" and are available with companion flanges conforming to American Standard Class 125 Cast-Iron Pipe Flange specifications.

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**Except fluorine and molten alkali metals.*



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Approved For Use With Drinking Water

Use Riviclor for all in-plant piping of mild or strong corrosives at normal temperatures . . . for liquid lines where "sweating" or corrosive vapors are problems . . . for underground piping. Pipe, fittings, diaphragm valves from ½" to 2".

Ask for Technical Bulletin CE-56.

ABBREVIATED TABLE OF CHEMICAL RESISTANCE

ACIDS		BASES		MISCELLANEOUS			
Acetic 50%	S	Ammonium Hydroxide 28%	S	Ethyl Alcohol	S	Carbon Tetrachloride	S
Chromic 25%	S	Sodium Hydroxide 50%	S	Methyl Ethyl Ketone	U	Plating Solutions	S
Hydrochloric 38%	S	HALOGENS		Gasoline	S	Photographic Solutions	S
Hydrofluoric 50%	L	Sodium Chloride Sat.	S	Mineral Oil	S	KEY: S—Satisfactory	
Nitric 20%	S	Ferric Chloride	S	Animal Oil	S	L—Limited to certain applications	
Sulphuric 50%	S	Sodium Hypochlorite 5%	S	Vegetable Oil	S	U—Unsuitable	
Sulphuric 98%	S			Phenol 10%	S		
				Chlorine 5%	L		
				Alum	S		

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
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data and the Palmer equation. They should replace those shown on my original graph.

W. R. GAMBILL
Union Carbide Nuclear Co.
Oak Ridge, Tenn.

Pro: Computer Control

Sir:

I have just read with interest the provocative article by Dr. Robert Hooke, "Control by Automatic Experimentation," which appeared in your June issue (pp. 284-286).

During the past few years we have seen the introduction of some powerful schemes for the exploration of response surfaces, e.g., the Box-Wilson method. These form the bases for the identification of the so-called "process equation." It seems natural that there should be a closer association between the utilization of these experimental designs and computer control.

Dr. Hooke's article serves as a clear introduction to the field of computer control, which shall become increasingly more important to engineers in research, development and production.

SIDNEY I. NEUWIRTH
Consulting Statistician
Flushing, N. Y.

Pro & Con: Spot Checking

Sir:

I fully realize the difficulty you have in originating pertinent, timely and technically accurate material for your magazine. Nevertheless it seems to me that you have reached a new low in your "Spot-Checking Cuts Control Lab Costs," supplied by some unknown (or at least nameless) author for page 156 of your July issue.

Permit me to point out the facts:

(1) *"Owens-Corning maintained quality control."* They did nothing of the kind. They merely relied on the quality control of the vendor. There is nothing wrong with this. But to try to pretend that 20 spot checks will maintain control is silly. The spot-check testing technique is necessary for nondestructive testing. But no one can pretend that it will put a

process under control. The spot-check on rifle bullets gives a statistical index on the probability of duds; that's all. It doesn't control anything.

(2) *"Owens-Corning is saving $10,000/yr."* This could be a true statement, but if so, it means that Owens was paying more than $50 each for the 180 tests which they "saved" in laying off the two technicians. A good flame spectrophotometer would enable a test for Na_2O to be made in 5 min. or less. So the opportunity for further economy is obvious; buy a flame spectro, transfer the foreman, lay off the remaining technician and hire a part-time high school girl to run the tests required.

(3) *"Management's resistance towards spot-checking."* What this says is that there are still some fairly level-headed executives who will not be rushed into eliminating chemical control laboratories in the interest of a pseudo economy. This is not because they "fear the untried," and it most certainly is not because they hesitate to fire surplus personnel. It could just be that the glass fiber process has been so well developed that glass composition is not very critical. If so, then it's an advance in glass technology. But this is not the result of spot-checking.

I should think you might like to show the economy of modern instrumentation rather than such sophomoric items as this.

EDWIN P. ARTHUR

Fullerton, Calif.

▶ *We can't help but wonder how carefully Mr. Arthur (who failed to identify his company connection or occupation) read this article, in view of his reference to "some unknown (or at least nameless) author." Although the article's published form was fashioned by our own staff, we indicated quite plainly that the facts and opinions expressed therein came from Gerald Mahnken, control lab supervisor for Owens-Corning Fiberglas Corp., Kansas City, Kan. Mr. Mahnken's name is mentioned five times in less than one page of text. Other erroneous inferences drawn by Mr. Arthur are negated in Mr. Mahnken's reply which follows.*

We do like Mr. Arthur's idea of an article on the economy of modern control lab instrumentation. In fact, we began work

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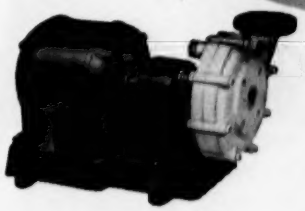
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1. Microphotograph of crystal structure as it occurs in raw material requiring centrifugal separation of liquid and solids.
2. Microphotograph of the same crystal structure as it occurs after centrifugal separation of liquids and solids in a suspended type machine featuring fixed slow speed discharging.
3. Microphotograph of the same crystal structure shown at 1 as it occurs after centrifugal separation of liquid and solids in a conventional type centrifugal. Note deformation of crystals due to crushing during high speed discharging operation.

ROBERTS STEVENS

The WESTERN STATES MACHINE COMPANY

HAMILTON, OHIO, U. S. A.

along these lines a number of months ago, resulting in the article appearing on pp. 160, 162 of our September issue.—ED.

Sir:

Thank you for the opportunity to reply to Mr. Arthur's letter.

The degree of effectiveness of a control laboratory is reflected in the manufacturing process and in the end product. During the period of use of the spot-check at OCF, production has been efficient and relatively trouble-free. Quality has been excellent. Based on this, the spot-check is a positive and effective control measure.

The test frequency on trona was used merely as an example of the spot-check. As clearly pointed out in the article, our $10,000-yr. saving has resulted from extension of the spot-check to many other raw materials. These materials range from phenol-formaldehyde resin to a quartz feldspar mixture taken from the Kansas River. (Both materials, incidentally, present delicate control problems.)

OCF has a well-equipped laboratory. Instrumentation has played an important part in what success we have achieved. At the present time, the OCF Research Center is adapting infrared analyses and the X-ray spectrophotometer to the glass fiber process. Both instruments will soon be available to the factory laboratories; however, I anticipate no increase in raw material test frequency. The extra testing capacity will be absorbed by plant expansion and diversification.

The two technicians mentioned in the article were not laid off. One was promoted, the other resigned to attend college. It is demoralizing to a technician to do a large volume of testing when it is of questionable value. When the spot-check is used, the technician is increasing his effective productivity and is in a better position to receive higher wages.

I suspect that many laboratories in industry today are fat cats that cut deep into corporation profits. They are sleek and satisfied. When they are questioned, they send out yowls of technical double-talk calculated to intimidate cost-cutting executives.

I realize that the cost reductions attributed to the spot-check have been modest, but in a growing company small savings today are big tomorrow. In this

time of ever-increasing prices, perhaps we need a grass-roots movement to do something about it. Control laboratories can do their share by honestly facing up to the situation.

GERALD G. MAHNKEN
Owens-Corning Fiberglas Corp.
Kansas City, Kan.

Right B.p., Wrong Gas

Sir:

On p. 298 of your May issue you indicate that the temperature of liquid nitrogen is —423 F. Liquid nitrogen boils at —320.4 F., while liquid hydrogen boils at —422.9 F.

GERALD GOLUB
Allentown, Pa.

Off by $(3{,}600)^2$

Sir:

We were delighted to see the fine job you did on our article in the August issue ("Equations Simplify Fluid Metering," pp. 259-262). The curves and other data were well presented, and we are well pleased with the results.

While going over this article with one of my associates, I discovered an error in Eq. (8) for economics of metering gases. The factor 228,000 should be 0.0177. This error came about when we were discussing the formulas over the telephone and attempting to convert w from lb./sec. to lb./hr. Instead of multiplying the factor 63.7 by 3,600, we should have divided.

E. B. LYNCH
Builders-Providence, Inc.
Providence, R. I.

Pro: Cost Engineering

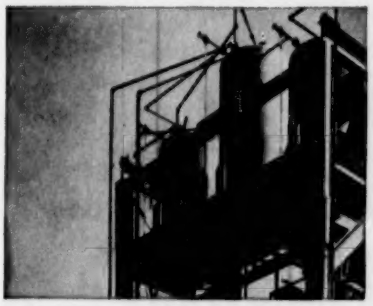
Sir:

After reading your article on "What Is 'Cost Engineering'?" in the July issue (pp. 237-239), I would like more information on the American Association of Cost Engineers. How do I apply for membership?

W. A. ARMSTRONG
Ltd.
Tonawanda, N. Y.

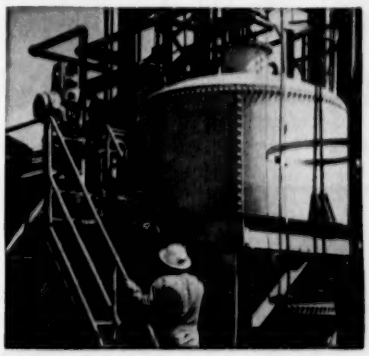
▶ *Readers who are interested in AACE can get further information and application forms from Edward D. Shanken, Executive Secretary, University of New Hampshire, Durham, N. H.*—ED.

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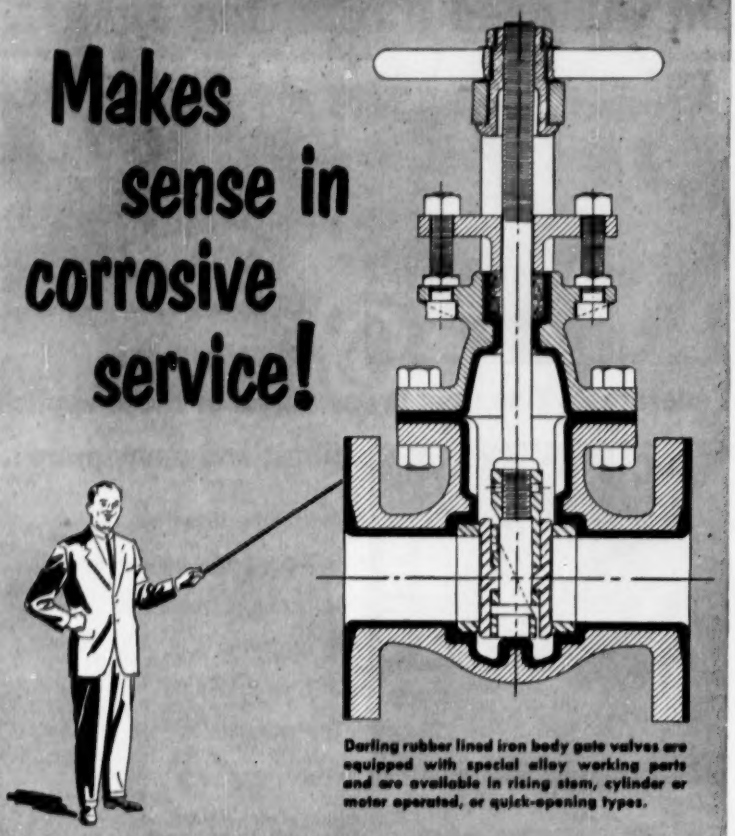
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NAMES IN

Fred H. Rhodes . . .















THE NEWS

M. A. GIBBONS

Man of the Month

Founder and head of chemical and metallurgical engineering at Cornell retires from his post.

On the 28th of this month, Cornell University will hold a testimonal dinner at the Plaza Hotel in New York City. Occasion? Fred H. ("Dusty") Rhodes—one of the most colorful figures on any American chemical engineering campus has retired from the Ithaca School's faculty.

The occasion is a bit special. This will be no ordinary tribute to a retiring professor.

For one thing, Rhodes not only directed Cornell's School of Chemical & Metallurgical Engineering for the past 25 years, he founded it when students potentially interested in its subject matter were limited to courses in industrial chemistry.

▶ **New School**—Here's how it happened.

During the Twenties, Rhodes was a professor of industrial chemistry at Cornell, under Professor Louis Dennis—head of the department of chemistry. Cornell people report that at the time, anything resembling chemical engineering in the department was no more than a figment of Dusty's vivid imagination.

Then, in the midst of the depression, Rhodes managed to convince Dennis that there was such a thing as a chemical engineer. Convinced him, that is, to the limited extent that a degree in the field would be granted to anyone who completed an additional year under Dusty's direction beyond the regular four years required for the chemistry degree.

It wasn't till 1938 that Dusty got his School of Chemical Engineering and it was another four years before Olin Hall could be built to house the new School.

The war presented another



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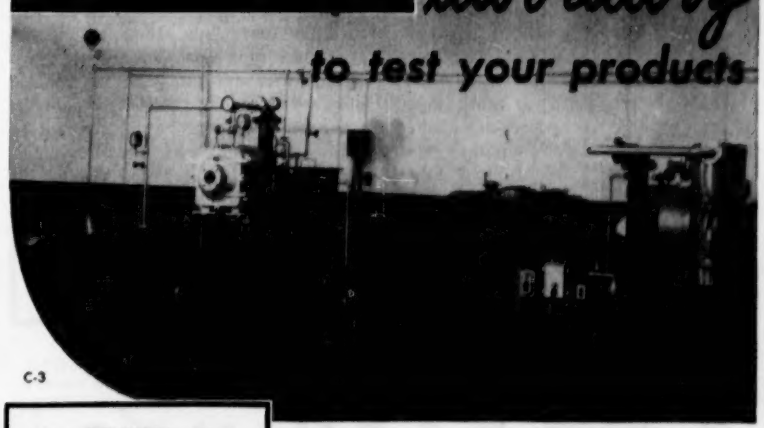
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drawback when Dusty had to put up with the fact that the Navy cluttered up his building during the next four years. It wasn't very long, though, before each officer of the day realized that Olin Hall belonged to Dusty and had to be treated as his personal possession. Occasionally, this completely upset military procedure when Annapolis graduates were assigned such chores as closing windows and putting out the lights at the end of the day.

Since that time, however, no other contender has appeared to challenge Dusty's reign. (If the U. S. Government didn't succeed, who could?)

▶ **Heart of the Matter**—On top of the fact that he nurtured Cornell's School of Chemical Engineering, Rhodes is famous—or is it infamous—for his various and unusual methods of dealing with the little things in everyday life.

For instance, what it means to be among the "Rhodes Scholars" at Cornell can best be illustrated by stories, often grounded in fact, about how tough Dusty's course in report writing actually was. The most reliable information holds that the subject matter was stiff enough but that Rhodes' ingenious system of grading—which he devised himself—was something to be reckoned with. He usually gave two marks: one for content, one for style and English usage. For the final grade, he multiplied the two figures and divided by 100. Two 100's brought a final grade of 100 but two 95's rated only 90 and two supposedly passing marks of 70 earned a final failing grade of 49.

After students failed three or four papers, they usually did superior work.

▶ **Infamy**—Want more evidence? Listen to this classic Rhodesian anecdote:

One year, Dusty assigned a final exam, on the last day of school, in a course that usually didn't have an exam. The night before the big day, he took part in a beer party with students from the course. As the evening wore on, the students did their best to get him to admit that he didn't plan to read the papers—but in vain. Un-

daunted, seven brave students ventured to devote their exam papers to a thorough description of the festivities. Then each went home for summer vacation.

Rhodes did read the papers and promptly ordered the notorious seven to report for another exam or be dropped from the School. (One student had to come back all the way from Milwaukee.) After the makeup test, Rhodes told them that this time they were right.

He did not read the papers.

Another Rhodes classic took place during Cornell's Annual Engineers' Day. At a chemical engineering exhibit, a faculty member was inviting the public to look through a microscope at the structure of steel and to describe what they saw there. Naturally, he wasn't encouraging little children.

Meanwhile, back in Dr. Rhodes' office, the occupant was busy coaching an eight-year old girl. He then scurried her off to the exhibit where she tugged at the professor's coat until he let her have a look too. After a cursory glance, she chirped, "Oh, see the graphitic precipitation of carbon in the grain boundaries."

▶ **Fame**—But Cornell students have other stories to tell too—stories about the finer side (as their interest go) of Dusty's ventures.

One such story is that Rhodes has often loaned funds to students, out of his own pocket, without tagging on any interest.

Another is that, until the Rhodes' home was sold, a chemical engineering student lived there each year with free board in return for small chores.

He also keeps close touch with Cornell's 800 alumni and frequently offers them help in getting better jobs.

And, it was Dusty who also demanded for his five-year graduates starting salaries equal to those offered to M. S. students from other schools. Because of Rhodes' stand on this subject, one chemical firm failed for nearly ten years to hire a Cornell chemical engineer. (This year's minimum is set at about $500 a month.)

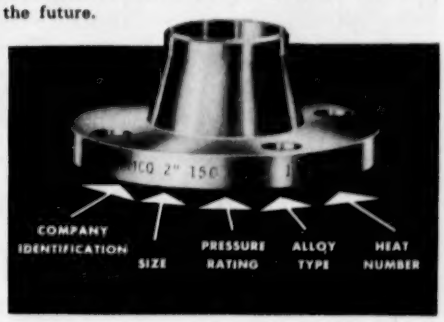
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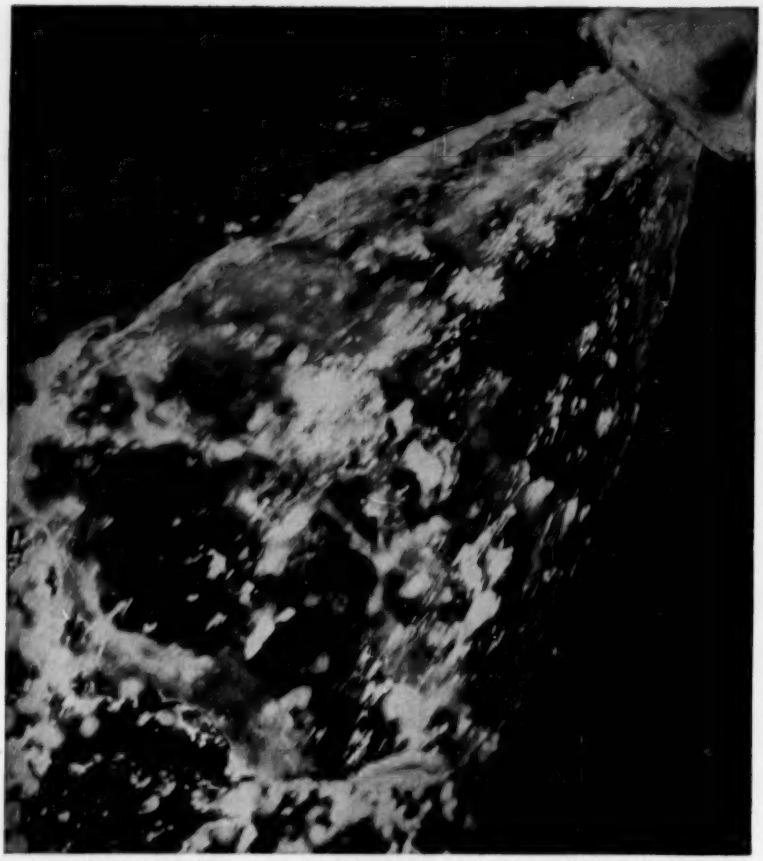
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Then, there's the chemical engineering loan fund, which he started. The fund makes interest-free loans to any student applicant. Though nominally administered by the university, the biggest chunk of its money has been raised (and all of its loans appropriated) by Rhodes. Most prolific source of the money is the Cornell Alumni—whom Rhodes thinks owe something more for their education. He usually accosts them on commencement day with the statement, "You owe me fifty dollars."

All winnings from Rhodes' poker games (formerly a regular event) have gone into the fund too. Dusty chivalrously used to credit losers with a gift. Then he would happily inform the university treasurer's office that "A donation of such an amount had been received from so-and-so. Please acknowledge it."

Incidentally, students now benefit in another way from Dusty's poker exploits. His interest in the card game prompted an interest in statistics which in turn led to his organizing and teaching a course in the subject —one of the first offered in an enginering school.

▶ **The Old College Try**—Rhodes' very personal interest in the School of Chemical & Metallurgical Engineering led to a few attempts to increase school spirit.

One such attempt was a bit abortive: Several years ago, he introduced a school tie—apparently chosen to look bad with any article of clothing—to be sold for 87 cents. He announced that students in his classes had better wear it, and the first year, some 200 were sold. In retaliation, students soon had a vest made for Rhodes of the same material. Dusty quickly lost interest in enforcing the tie dictum.

Other attempts, though, had greater success. Dusty had a booklet printed of "Ye songs—both sprightlie and doleful—of ye honourable and dystinguysed companie of ye chemical engineers." The cover blurbed it as "a revysed and expurgated edition containing manie of ye quaynte and sentimental ballades and ye tuneful ditties intoned

by ye members of ye affociation as sette forthe above." It was quite popular.

A school song composed during a beer party is also extant.

There was once a school orchestra, too, for which Rhodes scrutinized applicants' musical as well as engineering talents.



R. E. Workman

Goodyear International Corp. has set up a new chemical division to handle overseas sales of Goodyear chemical products and R. E. Workman has been named its manager.

Workman, who has been awarded a Sloan Fellowship to MIT, will be absent from his post for one year. He has been associated with Goodyear since 1942. Most recently, he had been assistant to the general manager of the chemical division.

Educational background includes a B.S. in chemical engineering from Case Institute. Workman holds membership in the AIChE, the Chemical Market Research Ass'n and the Society of Plastics Engineers.

Joseph R. Leal has been transferred from his post in Bound Brook, N. J., to American Cyanamid's Washington office as a technical representative.

John W. Barger has been appointed senior chemist at Midwest Research Institute, Kansas City, Mo. He had been with Du Pont in Waynesboro, Va.

Roy E. Miller, chemical engineering graduate of Northwestern University, has joined Monsanto Chemical's re-



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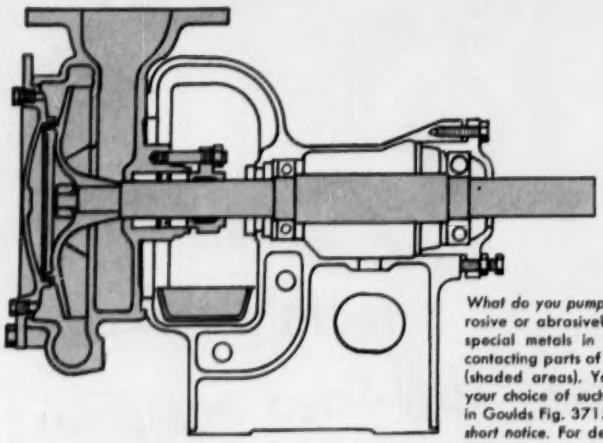
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NAMES . . .

search department, organic chemicals division in St. Louis, Mo.

D. S. Davis has been named to head up the department of pulp and paper technology in the University of Alabama's chemistry school. Formerly, he taught at Wayne University and at Virginia Poly.



T. H. Davies

The Mellon Institute has selected Thomas Harrison Davies as a director of research. Davies has been the administrative head of the multiple fellowship sustained in the Institute since 1952 by Pittsburgh Plate Glass Co.

Prior to his association with the Institute, Davies was an associate professor in the University of Chicago's department of chemistry, Institute for Nuclear Studies. He became affiliated with the University in 1946 and served as acting director of the Institute of Radiobiology and Biophysics during 1951 and 1952.

Earlier in his career, Davies was an associate section chief of the Clinton Labratories at Oak Ridge, Tenn., 1943-1946.

William Herbst has been made supervisor of starch applications research in the Plainfield, N. J., laboratories of National Starch Co. **Irving Martin** has been named senior chemist.

W. E. Hanford has been appointed assistant to the president for research at Olin Mathieson Chemical Corp. He had been a vice president and a director of M. W. Kellogg.

James H. Noyes has been appointed plant manager of the National Lead-operated AEC installation in Fernald, Ohio. Noyes has been assistant manager since 1953.

Otto J. Mileti, Jr. has joined Napko Corp. as technical director. Formerly, he was lab supervisor of the Schaefer Varnish Co., Louisville, Ky.

Robert D. Fremgen, former member of Goodyear Tire & Rubber's technical staff at Akron, Ohio, has joined the chemical development department of National Cash Register Co., Dayton.

James A. Roemer, president of Mallory-Sharon Titanium Corp., has been elected president of Reactive Metals, Inc.



Ronald E. Cannon

Chemical Engineering has taken on another full-time editor, in the Houston area, for more intensive coverage of the petrochemical and petroleum refining operations of the Southwest. The new editor is Ronald E. Cannon, a native Texan.

For the past two and a half years, Ron held a similar post for Petroleum Processing magazine. There, he handled a breezy chronicle of refinery life—The Bull Pen—which added up to an engineering cracker-barrel session. This column on top of his hefty contributions to the news and feature article sections gave him quite a reputation as Petroleum Processing's Southwestern editor.

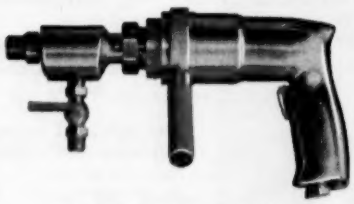
Before joining McGraw-Hill, Ron spent about eight years with Gulf Oil Corp. He started





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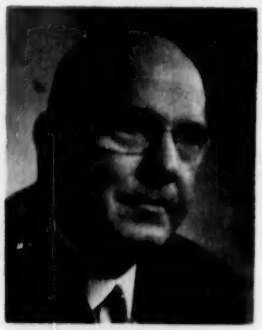
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out in the drafting room, got into construction and maintenance and handled two major assignments as a project engineer.

Ron's college education began at Tulane University while he was still in the Navy. He completed it in 1948, graduating cum laude in mechanical engineering from Louisiana Polytechnic Institute.



Alex Stewart

Former director of research for National Lead Co. and supervisor of the firm's atomic energy activities—Alex Stewart—has been elected president and general manager of R-N Corporation.

R-N Corp. is a new organization with headquarters in New York City. It controls a direct reduction process for producing high-metal iron products through the treatment of natural iron ores.

The new company is jointly owned by National Lead and Republic Steel Corp.

A. F. Anderson, liaison man for the past five years between the Owl Rexall Drug chain and the Rexall Drug Co., has been named vice president in charge of Rexall division chain operations.

Richard G. Rowe has opened an office as a consulting chemical engineer, in Redding Ridge, Conn.

Robert P. Obrecht has been appointed director of Stauffer Chemical Co.'s Richmond, Calif., research laboratory.



Leonard Brewer

The explosives division of Olin Mathieson Chemical Corp. has announced the appointment of Leonard Brewer as project director for rocket engines in the group's research and development department.

Brewer had formerly been associated with Thiokol Chemical Corp., Huntsville, Ala., where he held the post of department chief, pilot lines, solid propellant development.

From 1947 until 1952, he was with the Oak Ridge National Laboratories as a supervising engineer. Earlier in his career, he worked for Electric Storage Battery as a process engineer.

A native of Philadelphia, Brewer is a graduate of Lehigh University with a B. S. in chemical engineering.

Salvador Orochena and **I. G. Peters,** have joined the department of chemistry at Southwest Research Institute, in San Antonio, Tex.

Norman Roberson has been appointed production manager of Pacific Coast Engineering Co., Alameda, Calif.

John E. Morrow, Jr., has been appointed special representative, industrial products department, Sun Oil Co., Philadelphia.

Raymond L. Copson has been named to the post of assistant to the director of development, Solvay Process division, Allied Chemical & Dye Corp.

Otis Lock has been named assistant to the president of



exceptional quality for chemical processing

SAFE...RUGGED...DEPENDABLE

USG Solfrunt Gauges are built to withstand combined high pressure and corrosive process conditions with the utmost safety and dependability

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- **EASY CALIBRATION AND ADJUSTMENT**—Arc-Loc® Movement and gauge construction permit complete recalibration by merely removing blowout disc.

Solfrunt Gauges are available in 4½", 6" and 8½" sizes, for pressures to 20,000 psi. Call your local USG Distributor today . . . his name is in the "Yellow Pages" of your phone book . . . or write for complete information on gauge styles and construction.

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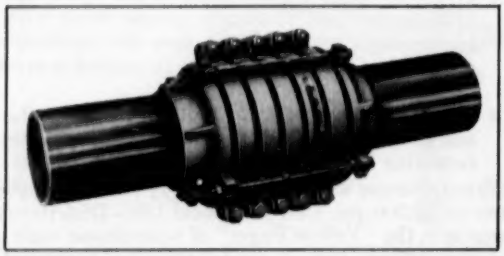
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NAMES . . .

Southland Paper Mills, Inc., Lufkin, Tex., plant which produces newsprint.

Warren G. Schlinger and **J. R. Morris** have been transferred to Texaco's Port Arthur research laboratory, Port Arthur, Tex., from other posts with Texaco. Schlinger will serve as a project engineer in fuels research; Morris is assistant supervisor in chemicals research.

Peter Huester has recently returned to the Tonawanda, N. Y., laboratories of the Silicones division, Union Carbide Corp., after a tour of duty with the Air Force.

Richard Floyd, recent graduate in chemical engineering from Purdue University, has joined Union Carbide Chemical's technical staff at the Whiting, Ind., plant.

George Reid, production superintendent at Western Phosphates, Inc., Garfield, Utah, has been named plant manager.



J. L. Galt

General Electric has named J. L. Galt as West Coast general manager for its chemical materials department.

Formerly, Galt had been marketing manager for the West Coast operation. He succeeds J. R. Patterson, who will remain at the California operation in a consulting capacity.

Galt originally joined GE in 1947 as a process development engineer. A subsequent assignment as supervisor of manufac-

turing engineering at the Pittsfield plant was followed up by a promotion to plant manager there in 1952.

He earned his chemical engineering degrees at the University of Texas and is a registered professional engineer in the Commonwealth of Massachusetts.



G. P. Hungerford

Gordon P. Hungerford of Pittsford, N. Y., has been appointed vice president of the Kordite Co., division of Textron, Inc.

As vice president, he'll head up all research and engineering activities of the Macedon, N. Y., firm. Hungerford joined the firm in July of last year as director of planning; in October, he was named general manager of research and engineering.

Before joining Kordite, Hungerford had been research manager of American Machine & Foundry Co., Stamford, Conn. He joined AMF in 1946 as a senior chemical engineer and took over duties as manager of chemical research and development in 1952.

H. Barclay Morley has been appointed supervisor in the inorganic research laboratory of Wyandotte Chemicals Corp. He had been with Hooker Electrochemical Co.

Richard A. Rall has been named chief engineer of Perkin Engineering's heavy duty rectifier division, in El Segundo, Calif.

Whitelaw Wright, Jr. has been appointed by the Spinco divi-

New uses found for unique properties of METALLIC OXIDE PIGMENTS



Product Planning



Product Improving

You ordinarily think of metallic oxide pigments being used to produce coloring agents, catalysts, polishing agents and magnetic materials.

Today, however, new product planners and production engineers are finding uses for the unique physical and chemical properties of metallic oxides which are surprisingly far afield from traditional usages.

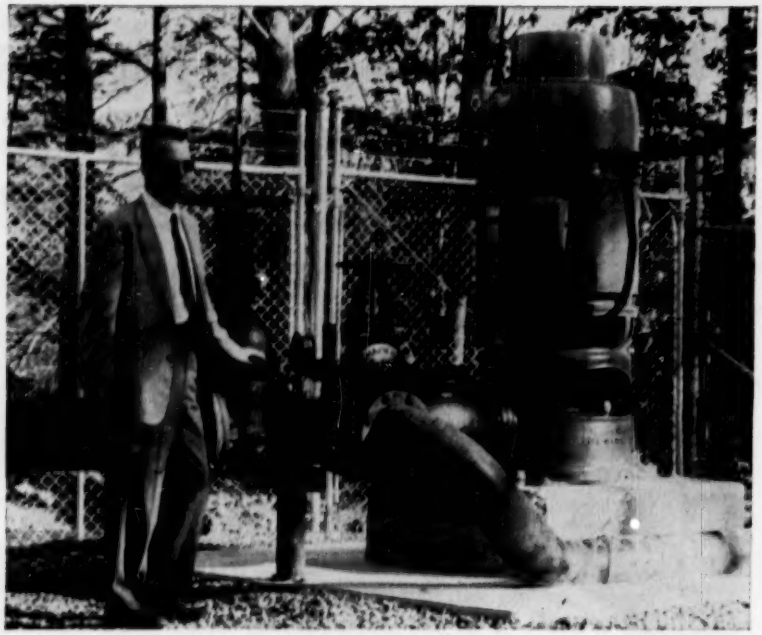
Below is a review of their characteristics. Look them over. You may get the germ of an idea which will lead to the improvement of existing products . . . or to the reduction of new product manufacturing costs.

Should an application suggest itself, write. We'll be glad to cooperate with you in exploring the possibilities. Address Dept. 62, C. K. Williams & Co., Easton, Penna.

Name	Properties	Characteristics
Pure Red Iron Oxides and Kroma Reds	Fe_2O_3-98.5% SpG.-5.15 Color—Salmon to purplish red	**Composition:** The basic colors of the iron and chromium oxides are determined by chemical composition. Reds are ferric oxide (Fe_2O_3); yellows, hydrated ferric oxide ($Fe_2O_3.H_2O$); blacks, ferro-ferric oxide (Fe_3O_4); and greens, chromic oxide (Cr_2O_3). All these compounds are chemically stable and light permanent.
Pure Yellow Iron Oxides	$Fe_2O_3.H_2O$-99% SpG.-4.03 Color—Lemon to dark orange	
Pure Black Iron Oxides	Fe_3O_4-96% min. SpG.-4.96 Color—Blue Black	
Pure Chromium Oxides (and Hydrates)	Cr_2O_3-99% SpG.-5.20 Color—Light to dark green	
Natural Oxides—Ochers, Umbers, Siennas, Metallic Browns, Red Oxides	Wide range of ferric oxide content and red, yellow and brown colors	**Particle Shape:** Physical properties such as oil absorption and suspension characteristics are dependent on particle shape, controlled by manufacturing processes.
Venetian Reds	Fe_2O_3-40% SpG.-3.45 Color—Light to medium red	**Size:** Color range is controlled by particle size—average size increases as color darkens. Uniformity of size determines brightness.
Cuprous Oxide	Cu_2O-97% min.	**Purity:** Freedom from impurities is essential for superior pigment properties and to prevent deleterious effects in end-products. Control of soluble salts, manganese and copper content are an important part of the Williams manufacturing operation.
Extenders—Barytes, Calcium Carbonate, Calcium Sulfate, Silica	Wide range	

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This Deming 4700 Vertical Turbine Pump discharges 1600 gallons of water per minute!

HOW LOW COST WATER CAN ADD TO PLANT PROFIT

High cost water can be an important factor in plant operating costs . . . knowing this, one eastern paper manufacturer checked into possible savings that might result from establishing and operating his own water supply.

First—A Deming distributor was consulted. Sydnor Pump and Well Co., Richmond, Virginia, made a preliminary survey of the ground water characteristics of the area.

Second—A test well was drilled to obtain complete geographical data.

Third—After studying survey results and geological data, a well 16 inches in diameter, 750 feet deep was drilled. A Deming 4700 Vertical Turbine Pump, water-lubricated type, was installed with a setting of 250 feet. The pump discharges approximately 1600 gallons per minute.

"We selected this Deming Turbine Pump for its water-lubricated design and semi-open, easily-adjustable impellers," said Mr. H. C. Berkely of Sydnor Pump and Well Co.

A Factory-Owned Water Works

This installation by an experienced Deming distributor meets the customer's present volume needs for pure water and provides for increased volume needs at lower cost.

For specific data on Deming Vertical Turbine Pumps, write for free BULLETIN 4700-A.

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DEMING

INDUSTRIAL PUMPS

sion of Beckman Instruments, Inc., Palo Alto, Calif.

Harry A. Collins has been named production co-ordinator for the fabricated products operations of Blaw-Knox Co. in Pittsburgh, Pa. He had been assistant works manager of the firm's equipment division.



James H. Worth

Celanese Corp. of America has appointed James H. Worth as assistant general manager of the chemical division.

Prior to this new assignment, Worth served as director of the division's technical and economic evaluation department.

Worth joined Celanese in 1953. Before that time, he had been associated with Monsanto Chemical Co. in various engineering, product development and sales posts.

A member of the AIChE, Worth earned his degree in chemical engineering in 1941 at Princeton University. He is a native of New York City.

R. L. Trieman has been named general superintendent of Crown-Zellerbach Corp.'s converting and multiwall departments in Antioch, Calif.

Richard Gerlach, Michael B. Keehan, Jerry Lott, and **Buddy D. Ratliff** have been promoted to assistant chemical engineering posts in Continental Oil's development and research department, Houston, Tex.

Jerry A. Acciarri has been appointed to research chemical

engineer in the petrochemical research division of Continental Oil Co., with headquarters in Ponca City, Okla.

Theodore I. Fand has been named technical director of product development at Warner-Chilcott Laboratories, Morris, N. J.

W. P. Morris, executive vice president of the Duval Sulphur & Potash Co., has been elected president of the firm. He succeeds the late **George F. Zoffman** who died June 5.

John T. Patton, Jr., has been promoted to the position of supervisor of alkylene oxide research, Wyandotte Chemicals Corp., Wyandotte, Mich.



Arnold J. Hoiberg

Flintkote Co. has appointed Arnold J. Hoiberg as assistant research director.

Hoiberg is an authority on asphalt technology. Previously, he was asphalt research director for the Lion Oil Co. in El Dorado, Ark. He earned a Ph. D. in chemical engineering from the University of Wisconsin.

As assistant director, Hoiberg will make his headquarters at the Flintkote research lab in Whippany, N. J.

Roy Dahlstrom has been appointed director of research of Nat'l Lead Co. In his new post, he'll supervise and coordinate the activities of all National Lead laboratories.

Eugene Pilczarski and **John Heidler,** University of Pittsburgh graduates in chemical

A Bunch of Tubes on a Bender



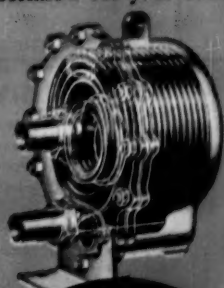
YOU'RE right — the place is New York's famous Bill's Gay Nineties.

But actually we put our tubes on a slightly different kind of bender and—*presto*—another Heliflow® Coil! Now hundreds of thousands are proving to America's foremost industries Heliflow's outstanding performance. Yes Sir, it all starts with a bunch of tubes on a bender!

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Unique Graham method of bending completely assembled Heliflow coil.



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INSTALLING LIQUID LEVEL GAGES

Penberthy "FLOATING SHANK"

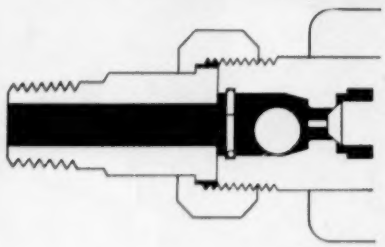
lines up off-center holes

Center-to-center variations of vessel tappings or gage assembly can cause costly, inaccurate mounting.



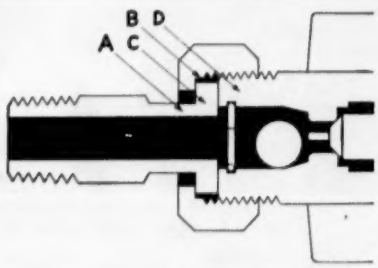
STANDARD SHANK

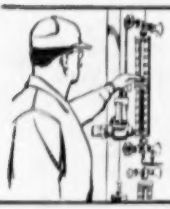
Minimum tolerance between union nut, nipple, and nipple flange prevents *any* corrective movement to compensate for inaccurate tapping. Gage and valve assemblies must either be "force-fitted" or vessel retapped.



FLOATING SHANK

Recessed neck (a) plus wide union opening (b) permit 3/16" movement of flange (c) in ANY direction. Together, "floating shanks" on top and bottom gage valves compensate for off-center tapping errors as high as 3/8". Ground flange (c) assures TIGHT metal-to-metal union with valve body (d).





...eliminates mounting strains

By permitting freedom of movement up to 3/8" in ANY direction Penberthy "floating shank" principle protects against mounting stresses . . . allows gage and valve assemblies to seek TRUE center to-center position between inaccurately tapped holes.

AN EXCLUSIVE EXTRA AT NO EXTRA COST



- cuts installation time and replacement costs by 50%
- provides true gage and valve alignment on incorrectly tapped vessels
- eliminates "force-fitting" and subsequent strains on gage and valve assemblies
- prevents possible damage to entire installation
- reduces unnecessary glass breakage due to gage distortion

WRITE for Catalog 36 showing complete line of liquid level gages and valves, Standard or special assemblies available through local suppliers or direct.

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INJECTORS
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LIQUID LEVEL GAGES
GAGE VALVES
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NAMES . . .

engineering, have received awards in a technical paper writing contest sponsored by Koppers Co.

Earl B. Hoglund, chemical engineer and former member of Du Pont's engineering department, has bought the Kasson Grain Co.—now renamed the Kasson Elevator Co., Kasson, Minn.



Alex F. Fino

Hammond Iron Works has named Alex F. Fino as chief engineer.

Fino has been associated with the firm since 1940. He has had principal responsibility for the design and development of many Hammond patented products.

Well known in petrochemical and technical circles, Fino is a member of the American Petroleum Institute and active on the organization's committee dealing with evaporation loss and tank standardization.

Arthur J. Warner has been named director of research for Mycalex Corp. of America and associated companies, New York.

H. Harold Bible has been named vice president and assistant general manager of Lion Oil Co., division of Monsanto Chemical, in El Dorado, Ark.

George Green has been appointed western district manager of the process instruments division of Beckman Instruments Inc., Fullerton, Calif.

Charles Schmidt has been named technical director of the titanium division of National Lead Co., New York.

J. H. McClintock and **A. A. Sanders** have been promoted to senior chemical engineers in the technical service division of Humble Oil & Refining Co., Baytown, Tex.

Hooker Electrochemical Co., Niagara Falls, N. Y., has appointed four new research supervisors: **R. J. Dearborn, Edward Leon, Lewis E. Tufts,** and **Edward Weil.**

David E. Schoeffel, a chemical engineer, has joined the research department of Monsanto Chemical's plastics division in Springfield, Mass.

David E. Evans has accepted a position in charge of commercial development with the McGean Chemical Co., Cleveland, Ohio.

Garvin H. Dyer, director of the Missouri Water Co. as well as manager and chief engineer of the Independence, Mo., division of the firm, has been elected president of the Nat'l Society of Professional Engineers.

Hamnett P. Munger, chairman of the department of chemical and metallurgical engineering, Syracuse University, has been appointed to the Air Pollution Commission of New York State.

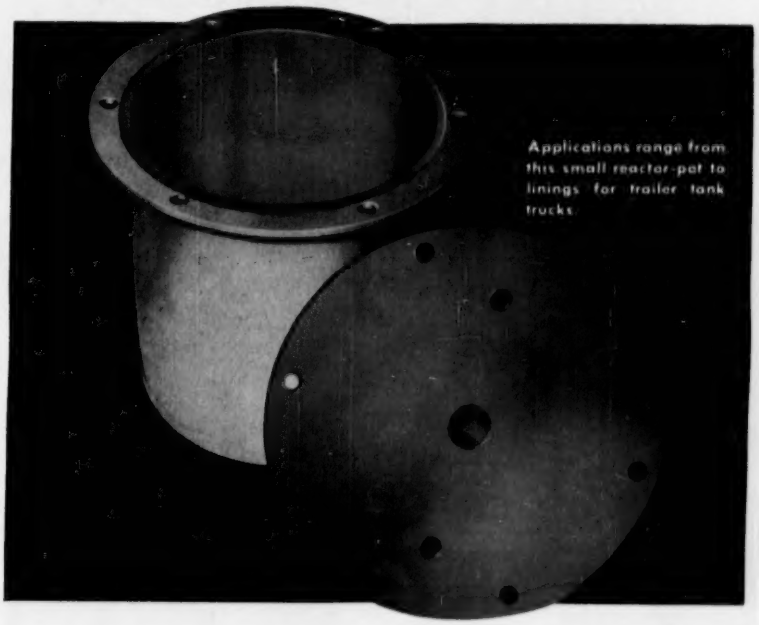
G. S. Williamson has been promoted to manager at Shell Chemical's Pittsburgh, Calif., plant. Till now, he had supervised the firm's Torrance, Calif., plant.

Harold D. McGowan, former vice president, general manager and part owner of Algonquin Chemical Co., has joined Shea Chemical Corp. as an executive vice president.

Richard S. Brief has joined the medical research division of Esso Research & Engineering Co., Linden, N. J., to con-

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...with **KEL-F LAMINATE** lining

Here is a method for making ordinary plant equipment (new or existing) resistant to gases and liquids as corrosive as fuming nitric acid—and at reasonable cost.

KEL-F Laminate comprises a tough, shatterproof, abrasion-resistant, frictionless surface of KEL-F* fluorocarbon plastic, bonded to a glass-cloth backing for maximum adhesion. It is readily cemented to any material of construction—metal, wood, concrete, etc.—and over a variety of contours.

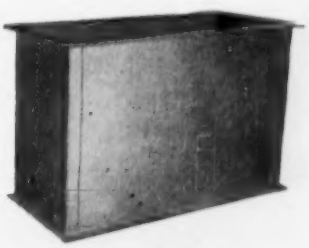
KEL-F, being a thermoplastic resin, seams may be "heat-welded". The result is a continuous surface having zero water absorption and extremely resistant to acids, alkalies, oxidants and solvents at temperatures up to 350°F.

KEL-F Laminates are manufactured by the United States Gasket Company, pioneers and leaders in fluorocarbon plastics, and are available for installation by certified applicators. Write for further information and the name of applicator nearest you.

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*Trademark, Minnesota Mining & Mfg. Co.

100 gal. Tank handling acid fluorides, lined with KEL-F Laminate.



United States Gasket *Plastics Division*

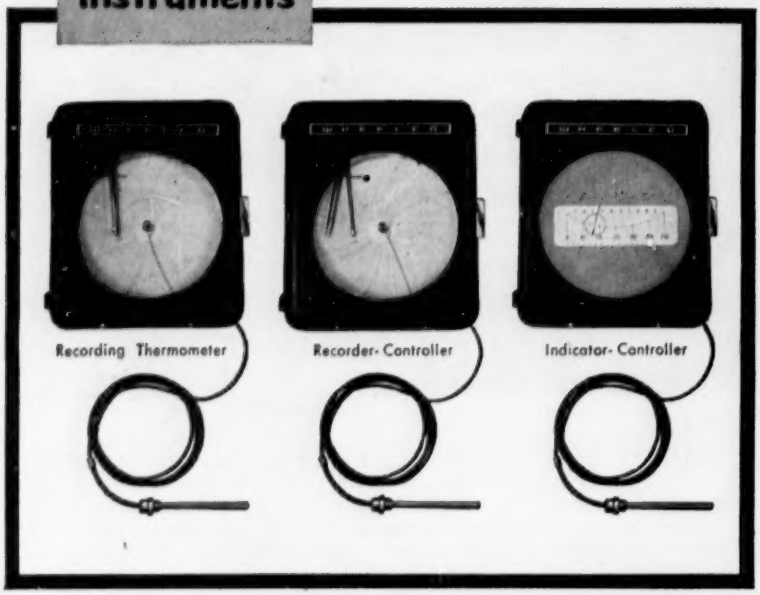
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New! 4000 Series Thermotrols for Indicating, Recording, and Controlling



New 4000 Series Thermotrols for indicating, controlling, or recording service have standard operating ranges of –40 to 1000° F. All are mercury-actuated with recorders being available as single-, two-, and three-pen units. A wide variety of control forms is possible because of plug-in chassis design.

Other outstanding features of the new Thermotrols line include: Invar metallic compensator for case, friction-free pen arms, electronic control action for controllers with the Wheelco "Electronic Link," and electric clock chart drives.

Bulletin T, 1585 has more data on these new Thermotrols. It's available from your nearby Wheelco field engineer.

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Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Electrical Components • Small Motors • Overdoors and Operators Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

centrate on industrial hygiene problems.

Philip W. Moore, president of the First Research Corp., Miami, Fla., has been elected president of the Southern Ass'n of Science and Industry.



Thomas P. Brown

In a move to broaden its administrative staff, Scientific Design Co., Inc., has promoted a number of its executives to posts with greater responsibility.

Among these men is Thomas P. Brown who has been named a senior vice president. Brown graduated in chemical engineering from Auburn. Formerly, he had been a vice president of Reichhold Chemicals, Inc.

In his new post, he'll coordinate the firm's research, development, sales and legal activities.

Walter J. Holder has been named manager of the Micro-Klean Filter division of Cuno Engineering Corp., Meriden, Conn.

J. W. Kincaid has been named manager of Crown Zellerbach Corp.'s new multiwall bag sales division.

J. Guy La Vergne has been promoted to chief engineer of Escambia Chemical Corp. He first joined the firm in 1955 as chief design engineer.

Larry D. Wheaton, recent chemical engineering graduate of the University of Michigan, has joined Union Carbide's Whiting, Ind., plant.

Wesley M. Johnson has been named by the USAEC as director of the technical liaison division, in New York. Johnson had been area manager in the Kansas City office.

Samuel B. McFarlane has been named manager of the fiber research department of the Summit, N. J., research laboratories of Celanese Corp. of America.

Jacob M. Skilken, Cincinnati, Ohio, chemistry teacher, has been selected by the Armed Forces Chemical Ass'n to receive its $1,000 science teacher award for 1957.

Burton H. Sanders has resigned his position as process engineer with Thiokol Chemical Corp. to accept a position with Nat'l Research Corp., Cambridge, Mass., as project manager.

A. Skrzec, B. J. Luberoff, Don Overbeek, J. Koretzky and **C. Wucherer** have been added to the research staff of Stauffer Chemical Co., at the Chauncey, N. Y., lab.

OBITUARIES

Joseph R. Minevitch, 65, president of J. R. Minevitch & Associates, Inc., died of a heart attack at his home on July 3. Minevitch came to this country in 1906 from Russia. He obtained his education in chemical engineering at MIT and at Tufts University.

In 1928, he joined the staff of E. B. Badger & Sons Co. He was associated with the firm and its successor—Stone & Webster Engineering Corp.—until 1955, when he entered private practice as chemical engineer and consultant. The company which bears his name was formed earlier this year to handle his private practice.

During World War II, he served as a consultant to the chemical division, war production board. He is a member of the ACS, the AIChE, the Society of Chemical Industry, and the American Institute of Chemists.

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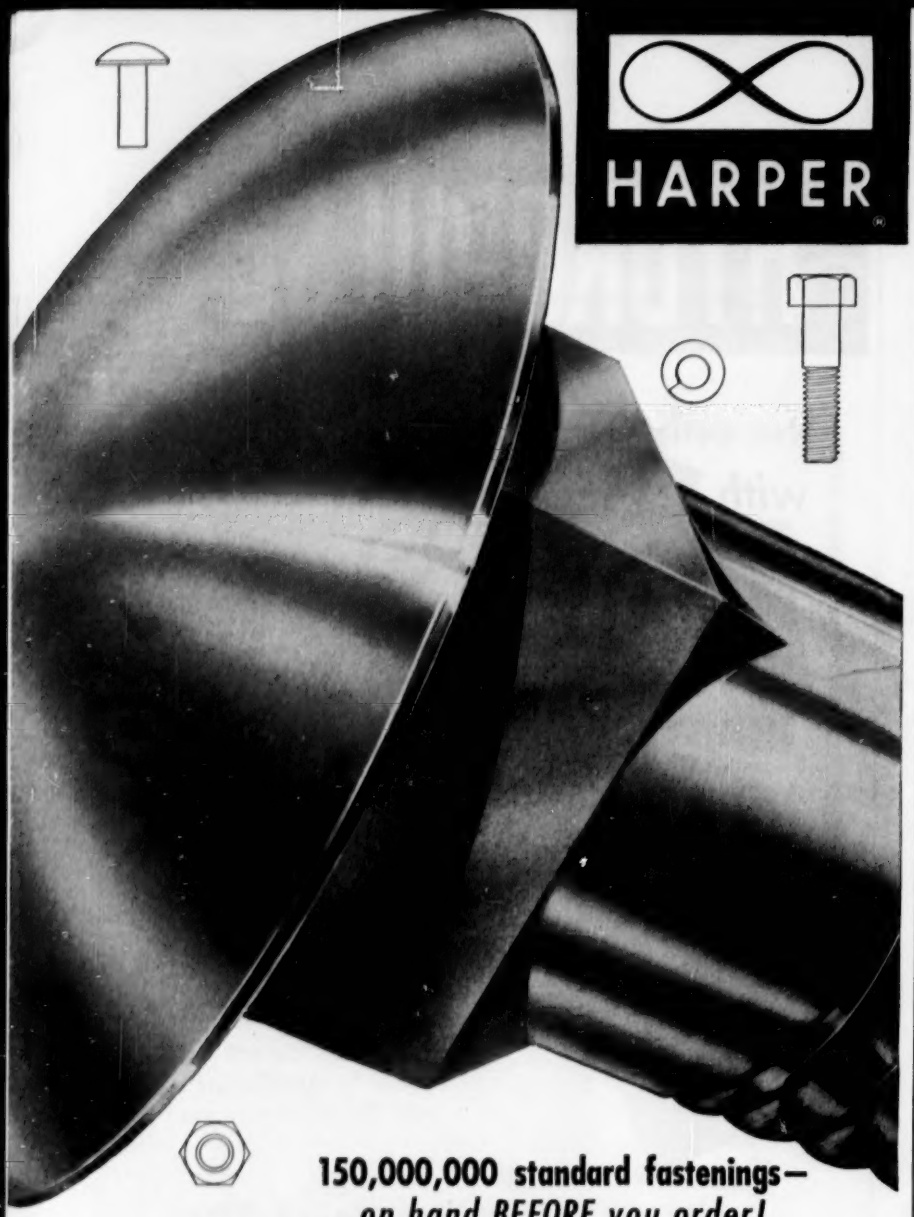
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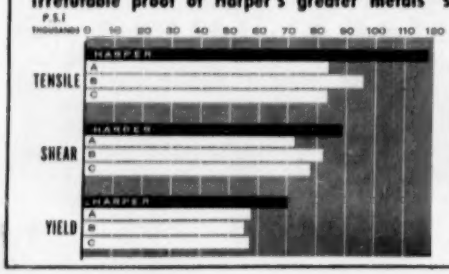


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An important point in buying fastenings is strength. Independent laboratory tests*, utilizing Stainless Steel Machine Bolts by Harper and three other leading producers, prove Harper superiority in Tensile, Shear, and Yield Strength. The chart at left shows the actual results of these tests. For complete information on these important tests, request Form No. 126.

*By R. W. Hunt Laboratories

PEOPLE . . .

FIRMS IN

NEW LOCATIONS

Callery Chemical Co. has moved administrative and sales offices to 9600 Perry Highway, Pittsburgh 37, Pa.

Cochrane Water Conditioning Ltd., subsidiary of Cochrane Corp., has established permanent headquarters in its new building at 1355 Martin Grove Rd., Toronto, Ont.

NEW LINES

Minneapolis-Honeywell Regulator Co. has leased a plant at Fall River, Mass., to produce a new line of electronic industrial controls.

American-Marietta Co., through purchase of assets and business of Sinclair & Valentine Co., has entered the printing-inks, pigments and chemicals fields.

NEW FACILITIES

Delhi-Taylor Oil Corp.'s new petrochemical plant is now on stream at Corpus Christi, Tex. Plant will produce 45 million gal./yr. of high-purity benzene, toluene and xylene.

Olin Mathieson Chemical Corp. will build research and development laboratories, pilot plants, test and production facilities near Marion, Ill., to kick off a four-year development program on high-energy solid propellants.

Gulf Oil is planning a 30-million-gal./yr. benzene and toluene plant at its Port Arthur, Tex., refinery. Procon is contractor. Scheduled on-stream date: late 1958.

Stauffer Chemical is building a $4-million sulfuric acid regeneration plant at Hammond, Ind. Plant will process 400 tons/day of oil-refinery sludge acids.

THE NEWS

J. B. BACON

Fansteel Metallurgical Corp. is nearing completion on its $6.5-million tantalum-columbium plant near Muskogee, Okla. Production of tantalum powder begins this month.

Columbia Gas System, Inc., will build extraction and fractionation plants to recover liquid hydrocarbons from rich Appalachian natural gas streams. Extraction plant will be built at Kenova, W. Va., and fractionation plant will go up at Siloam, Ky. Total cost: $13 million.

Procter & Gamble Co. has acquired property and assets of Clorox Chemical Co. of Oakland, Calif.

Utah Oil Refining Co. has awarded a $2-million contract to Fluor Corp. for design and construction of a 35,000-bbl./day crude unit. Unit will be built at Salt Lake City, will go on stream mid-1958.

Socony Mobil has contracted with a Swedish firm, Ericksbergs Mekaniska Verkstads, for five 48,600-ton supertankers at a total cost of more than $45 million.

Reichhold Chemicals has placed on stream its new 10-million-lb./yr. phthalic anhydride plant at Azusa, Calif. Production facilities cost $2 million.

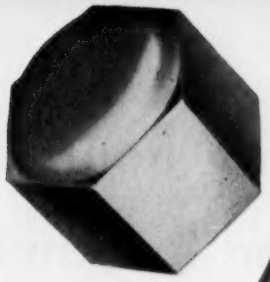
Davison Chemical Co. now has its new $6-million cracking catalyst plant in full operation at Valleyfield, Que. Catalyst is silica-alumina composite for fluid cat cracking.

Dow Chemical's Texas Div. early next year will start building a new acrylonitrile unit at Freeport, Tex. New unit will start production in early 1959.

Bunawerke Huels, Marl-Rechlinghausen, West Germany,

HARPER

CORROSION-RESISTANT FASTENINGS





Harper FLO-FORM Process
Saved money...made part better!

A manufacturer of an electrical hand tool was milling and slotting a copper conductivity pin from wire. The cost was too high—too many rejects. They called in the Harper Application Engineer who suggested redesign of the part for production by the Flo-Form Process. Now it is made at lower cost. There are no rejects. Grain structure is better. The part is stronger and more efficient. Your "special" problem can be solved by the Harper Flo-Form engineering team of designers, metallurgists, and tooling specialists with vast experience gained in over 33 years of solving fastenings problems. Save money. Send us your problem today or call your nearby Harper Branch for Harper Application Engineering Service.

Meet HENRY MULLANEY, Harper Application Engineer



Philadelphia design and production engineers who have called upon Mr. Mullaney for assistance with fastening problems know the value of his advice and counsel. Henry typifies the experience that can be applied to your fastening problems through Harper Flo-Form Engineering Service.

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This "heart-failure" can lengthen someone's life!



Pictured above is what happens when a pressure vessel protected by a BS&B Safety Head develops pressures above safe limits. "Heart" of the Safety Head is the rupture disc, which bursts to relieve the overpressure instantly and completely—guarding against injuries to personnel and damage to plant equipment.

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BS&B rupture discs are designed to relieve pressures at any specified point from 3 to 100,000 pounds per square inch. They are available in standard sizes ranging from ¼ inch to 36 inches in diameter, and in special sizes and types for virtually any application.



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FIRMS . . .

will use Houdry process and cuprous ammonium acetate extraction process in its $28.6-million, 45,000-ton/yr. synthetic rubber plant. Plant will go on stream in summer of 1958.

Atomic Energy Commission has awarded a contract to Walter Kidde Constructors for architectural design and engineering on office and laboratory facilities for Princeton University's thermonuclear Model C Stellarator.

U. S. Steel has dedicated its new plant near Provo, Utah, for making anhydrous ammonia, nitric acid and ammonium nitrate.

Spencer Chemical will build a new urea plant at its Henderson, Ky., works. New plant, to be completed in summer of 1958, will produce 100 tons/day of urea, will use Montecatini-Fauser process.

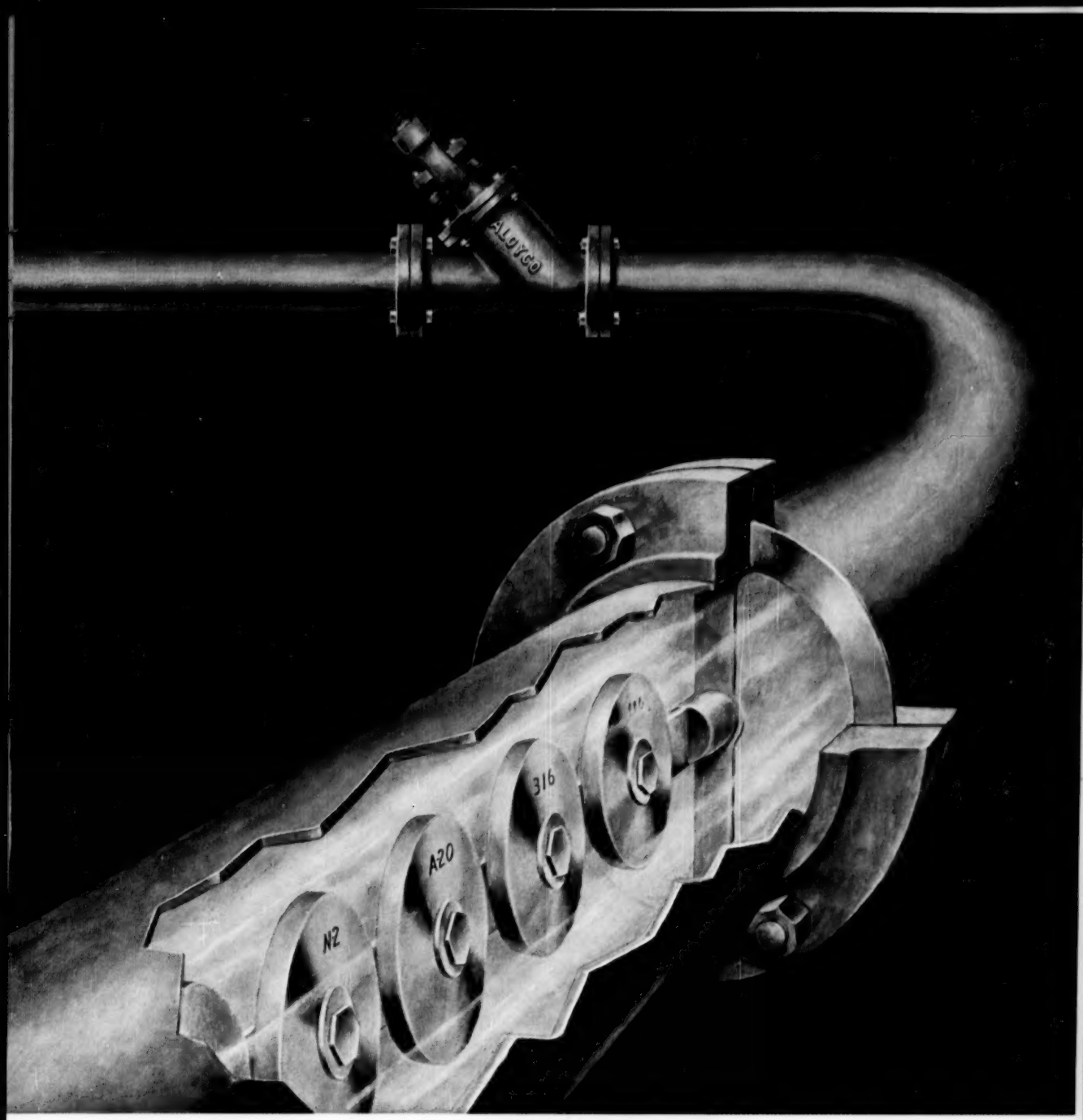
Spencer Chemical has started up its new nylon resin plant at Henderson, Ky.

Cities Service Oil Co. is building a new $9-million asphalt refinery at Linden, N. J. New refinery will replace Cities Service's present asphalt refinery now operating in Linden.

National Petro-Chemicals Corp., majority-owned by U. S. Industrial Chemicals, will build a second plant to produce USI's Petrothene polyethylene. New plant, scheduled for operation by late 1958, will turn out 75 million lb./yr. of intermediate-density resins. Gulf-Coast plant sites are being considered.

Canadian Industries Limited is boosting polyethylene output at its Edmonton, Alta., plant from 22 million lb./yr. to more than 40 million lb./yr.

Steen Resin & Chemical Co. has broken ground in Chicago Heights, Ill., for a 25-million-lb./yr. plant to make alkyd, vinyl, copolymer and a host of other resins. Com-



Inside look at Aloyco Corrosion Engineering Service

This is a realistic illustration of an Aloyco line test—as it might be conducted in your plant as a regular part of Aloyco Corrosion Engineering Service.

Whenever there is no 'book solution' to a specific valve problem, we will prepare a test rack carrying a series of alloy specimens (discs above) to be inserted in your process line. Purpose is to pinpoint the alloy that will most efficiently stand up to the specific corrosives under your actual line conditions.

Our sole purpose with the Aloyco Corrosion Engineering Service is to help you successfully solve corrosives-handling problems. Our resources are the metallurgical experience, foundry skills and engineering know-how we have gained in twenty-seven years as the world's largest specialist in Stainless Steel Valves.

Bring your corrosion problem to Alloy Steel Products Company, 1301 West Elizabeth Avenue, Linden, New Jersey. 7.2



ALLOY STEEL PRODUCTS COMPANY

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every foot you install saves you $5 to $6

ARMORTUBE Cable consists of multiple copper or aluminum tubes in a single, flexible armored cable. You string *one* line. You buy *one* set of standard pipe supports or conduit clips. You make a neater, protected installation. Installation costs are reduced tremendously.

Users of copper or aluminum tubing for connecting pneumatic instrument and control lines report that it costs about $2.00 a foot to install single tubes.

It costs the same $2.00 a foot to install Bailey ARMORTUBE Cable.

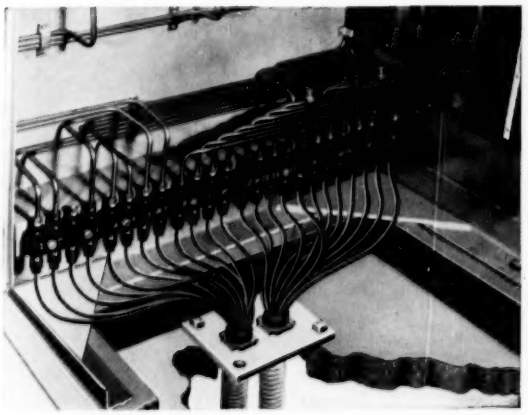
But here's what customers tell us . . .

SAVES $3,000—A chemical plant bought 530 feet of 4-tube Bailey ARMORTUBE Cable and installed it at a saving of $3,000 over the cost of four single tubes.

SAVES $14,000—Another chemical plant bought ARMORTUBE Cable costing $1,345. The saving on installation compared to single tubes amounted to $14,000.

SAVES $60,000—An electric utility bought $14,068 worth of ARMORTUBE Cable . . . saved $60,000 on installation.

Whether your next job consists of 100 or 100,000 feet of tubing, it will surely pay you to check on savings possible with Bailey ARMORTUBE Cable. For more information ask for Product Specification and Price List G91-9.



NOW—to meet increasing demands, this cost-saving product is offered in a full family of sizes and types. In the quarter-inch tube size, ARMORTUBE is available in both copper and aluminum with 2, 3, 4, 5, 7, 8, 10, 12 or 19 tubes. Tubes are protected with galvanized steel armor or a combination of steel armor and thermoplastic . . . with thermoplastic sheath located either over or under the steel. Other sizes are copper tubes in steel armor only: ⅜″ in bundles of 1, 2, 3, 4, 7; ½″ in bundles of 1, 2, 3, 4. G-38

Instruments and controls for power and process

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BAILEY METERS

pletion is slated for April 1958.

Benzin-und-Petroleum Gesellschaft will start construction before the end of this year on its projected Ruhr refinery near Dinslaken. Refinery will have 80,000-bbl./day capacity, will cost $83 million.

Atlas Powder Co. has added a new nitric acid and ammonium nitrate facilities at its Atlas, Mo., plant at a cost of $4 million. New acid plant is "self-sustaining" type, recovers heat from burning ammonia for power requirements.

General Aniline & Film is in full production at its new surfactant plant at Calvert City, Ky. Plant produces alkyl phenols, Igepal and Alipal surface active agents.

California Portland Cement Co. has added three kilns at its plant near Mojave, Calif., boosting capacity from 38,000 sacks/day to 70,000 sacks/day.

Monsanto is boosting maleic anhydride capacity at its St. Louis, Mo., plant by 10%.

Standard (Ind.) is launching a multimillion-dollar expansion at its Wood River, Ill., refinery, will build a 67,500-bbl./day crude distillation unit and a 30,000-bbl./day fluid cat cracker to boost capacity by 30%. Completion date: early 1959.

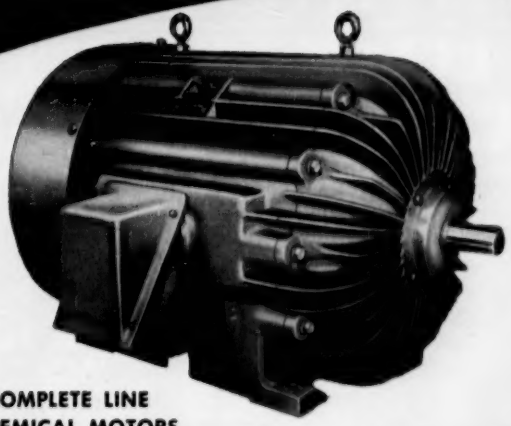
Reactive Metals is well along in construction on its multimillion-dollar zirconium and hafnium plant at Ashtabula, Ohio.

Lorado Uranium Mines has opened a $9.2-million uranium concentrating mill at Beaverlodge in northern Saskatchewan.

Western Gypsum Products, Winnnipeg, Man., has acquired capital stock of Westroc Industries of Vancouver, B. C., and Columbia Gypsum Co. of Windermere, B. C.

MARATHON ELECTRIC

CHEMICAL INDUSTRY MOTORS



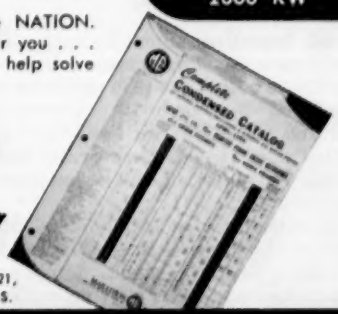
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MOTORS 1/20 HP thru 2500 HP

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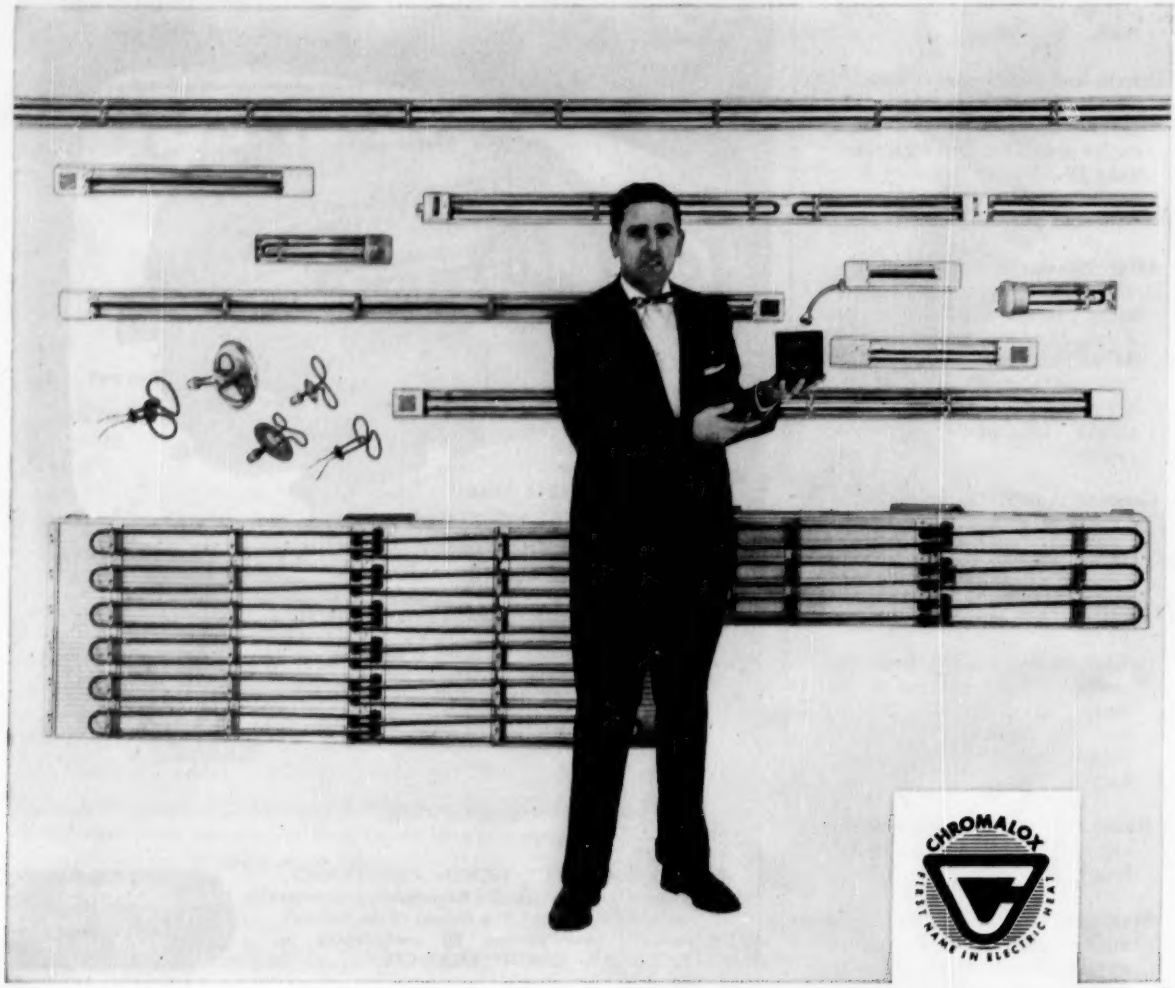
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Get the best answers to all your heating problems. For assistance on new installations, or on improving an existing system, call or write your Chromalox Sales Engineering Representative. Standard heaters, to fit most jobs, are ready for immediate shipment from the world's largest stock. What's more, your Chromalox Representative offers factory design-engineering service for special applications. He has the electrical answer that's fast, clean, safe, accurate and economical.

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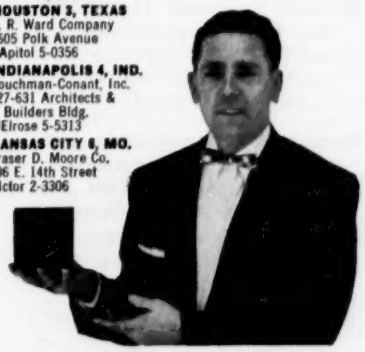
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HOward 3-2748

WICHITA 2, KANS.
Fraser D. Moore Co.
Room 211 Derby Building
352 N. Broadway
AMherst 2-5647



FIRMS . . .

Far East Corp. is setting up a 2,200-lb./day glacial acetic acid plant in the Philippines. Plant will go on stream December of this year, will supply the Philippines' present requirements.

Electro Metallurgical Co. is constructing an addition to the process research building at the Metals Research Laboratories at Niagara Falls, N. Y.

Stackpole Carbon Co. has opened production facilities for ceramic permanent magnets at Kane, Pa.

Atomic Energy Commission's Naval Reactor Facility at Idaho Falls, Idaho is well along in construction. Prototype nuclear propulsion plant is being designed by Westinghouse.

Norway and Britain will cooperate on a reactor project scheduled for operation at Halden, Norway in early 1958. Britain will supply initial uranium fuel elements. Reactor is designed to supply process steam for pulp mills and other industrial uses.

Britain has selected Trawsfynydd, Merionethshire, Wales as site for its fourth and latest nuclear power station. Central Electrical Authority also names Edern, Caernarvonshire as a possible site for another larger station.

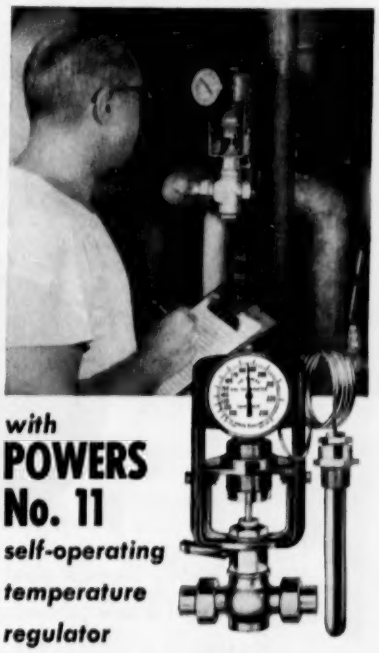
B. F. Goodrich Chemical Co. has launched an expansion to triple semiworks facilities for producing Darlan dinitrile fiber at its Avon Lake, Ohio, development center. Completion is slated for early 1958.

Allis-Chalmers Mfg. Co. has broken ground for a $3.25-million engineering and research laboratory at its Harvey, Ill., plant.

Electro Metallurgical Co. has completed a new laboratory at Niagara Falls, N. Y., for studying physical processes

VISIBLE PROOF

of constant temperature control



with
POWERS No. 11
self-operating temperature regulator

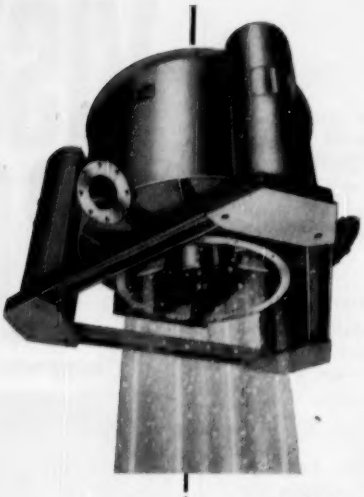
This big four-inch dial gives a quick, visual means of checking controlled temperatures . . . an accurate guide for regulator adjustment.

Designed for precise temperature control, the Powers No. 11 Regulator is self-powered . . . simple, compact and dependable. Full throttling action is gained without the aid of *any* external power source. Special valve stem lubricator eliminates binding. Big double ply metal bellows provide extra valve power — longer life. Union body assures easy installation.

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Tolhurst centrifugal cuts 48 processing hours down to 8



In a leading chemical plant, one Tolhurst Batch-Master centrifugal is now processing the same volume of fine organics in 8 hours as two other centrifugals formerly did in 24 hours. The reason: Tolhurst's hydraulic unloader and bottom discharge unload the solids in just 30 seconds. The other batch centrifugals with manual unloading took 15 minutes or more. And Tolhurst labor savings on the job amounted to 16 manhours a day.

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COMPANY

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involving solid particles ranging in size from 12 in. to less than a micron.

Deer-O Paints & Chemical Co. has launched a $100,000 expansion project at its Phoenix, Ariz., plant site.

Allmetal Screw Products Co., Garden City, N. Y., has opened a new Midwest division headquarters in Chicago, Ill.

Spencer Chemical has opened a West coast sales office in Los Angeles, Calif.

O. L. King of San Francisco, Calif., supplier of specialized oils, has acquired Dacus Oil Co., which sells automotive lubricants in the San Francisco Bay area.

Garlock Packing Co.'s United States Gasket Div. has placed in operation a new Nylon-Teflon extrusion plant at Camden, N. J.

American Aerophysics Corp., El Segundo, Calif., has added complete manufacturing facilities for developing and fabricating high-strength, fiberglass-reinforced plastics laminates for the aircraft and missiles industry.

Titan Chemical Industries is in full production at its new plant at Colorado Springs, Colo., producing aerosols.

Pittsburgh Coke & Chemical Co. has acquired the assets of Insul-Mastic Co. of Summit, Ill.

Sparta Mfg. Co. is expanding facilities for Teflon-coating metal and nonmetallic parts at its Dover, Ohio, plant.

General American Transportation Corp. has completed a new $750,000 plastics research laboratory at its East Chicago, Ind., plant.

Bendix Aviation Corp.'s computer division has announced an expansion program that doubles the size of its manufacturing facilities, and boosts production by more than 100 machines per year.

Narmco, Inc., has broken ground for a $1-million re-

search and development center in San Diego, Calif.

W. P. Fuller & Co. has opened a new $500,000 general research laboratory in South San Francisco, Calif.

Archer-Daniels-Midland Co. has purchased Federal Foundry Supply Co., Cleveland, Ohio, including the latter's bentonite mines in Colony and Upton, Wyo.

Dow Chemical Co. and its partner, Kilachand Devchand & Co., have started production at their jointly owned polystyrene plant in Bombay, India.

Manning, Maxwell & Moore, maker of industrial cranes, hoists and other products, has opened a new district office and factory warehouse in Bellwood near Chicago, Ill.

Chemical Process Co. is spending about $120,000 to boost capacity of its adhesives division by 250% at Redwood City. Facilities are scheduled to be in operation Nov. 1.

W. P. Fuller Co. has announced a $400,000 expansion program for Arizona that includes new retail outlet, warehouses and a store building at Phoenix and Yuma.

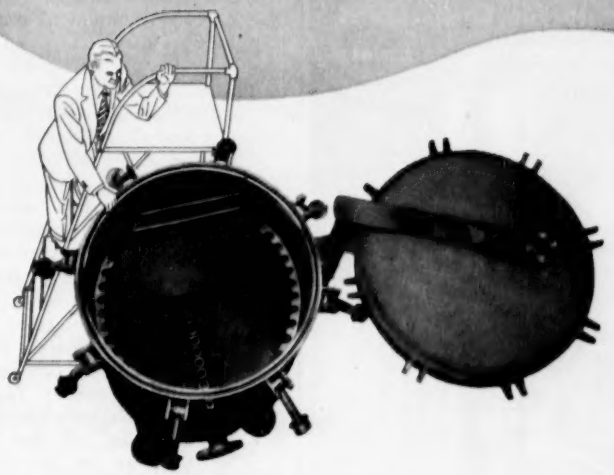
Stepan Chemical Co. has acquired Ninol Laboratories, Inc., Chicago, for about $2 million. Acquisition makes Stepan one of the largest producers of surfactants in the Midwest.

Southland Paper Mills has launched a multimillion-dollar expansion program, its second in three years. On order is a newsprint machine which will add 90,000 tons/yr. to annual production of its Herty, Tex., mill.

Fisher Scientific has opened a western Canada sales office in Edmonton, Alta.

B. F. Goodrich Co. is expanding headquarters facilities through purchase of a three-

HOW TO INCREASE the buying power of your filter dollar



Take a close look inside a Niagara Filter on the job and you'll see why it's your biggest dollar's worth. Look at its sturdy construction. Ask a user how long a Niagara Filter lasts . . . how little it costs per year. You'll find a Niagara lasts up to three times as long as a filter without this rugged construction and efficient design. So, your Niagara dollar buys *more*.

GET NAMES, DATA

Niagara FILTERS

A DIVISION OF

American Machine and Metals, Inc.

Dept. CE-1057, EAST MOLINE, ILLINOIS

(Niagara Filters Europe: Kwakelpad 28, Alkmaar, Holland)

☐ Send me names of Niagara users nearby.
☐ Send complete data on Niagara Filters for filtering_____

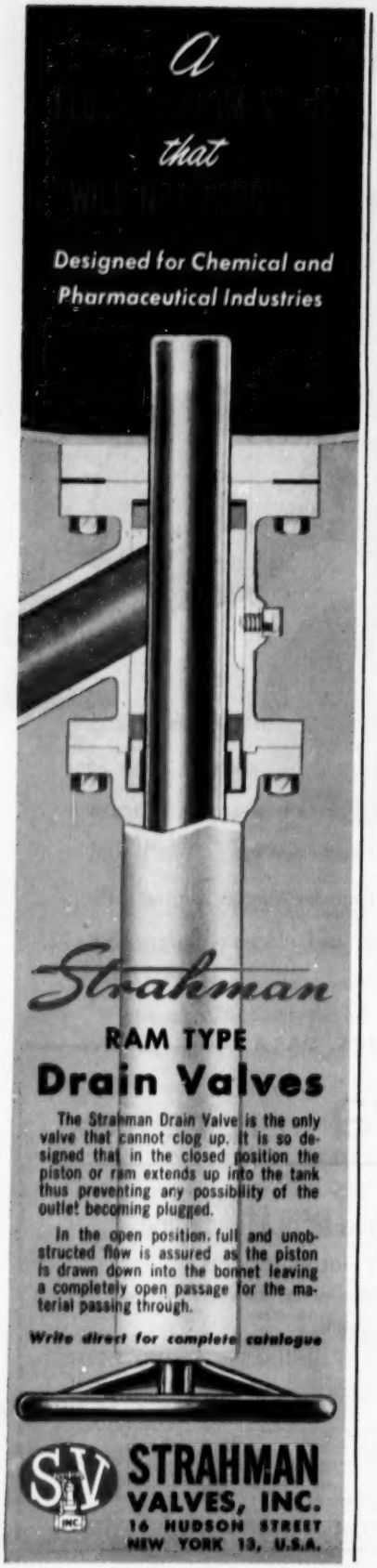
NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

SPECIALISTS IN LIQUID SOLIDS SEPARATION



FIRMS . . .

story building on property adjacent to its new general offices in Cleveland, Ohio.

South Dakota School of Mines and Technology, Rapid City, has completed a new $675,000 chemistry-chemical engineering building.

Texas Eastern Transmission Corp. has acquired La Gloria Oil and Gas Co., will operate firm as a subsidiary.

DeVilbiss Co. has agreed to purchase Newcomb-Detroit Co., manufacturer of custom-built industrial finishing equipment.

Sinclair-Collins Valve Co. has completed new design and testing laboratory facilities. Much of the new equipment has been designed and custom built by or for Sinclair-Collins.

NEW NAMES

Western Research Div. of Broadview Research Corp. is the new name of Western Research Institute after merging with Broadview Research Corp. of Burlingame, Calif. Western Research will have headquarters in San Francisco.

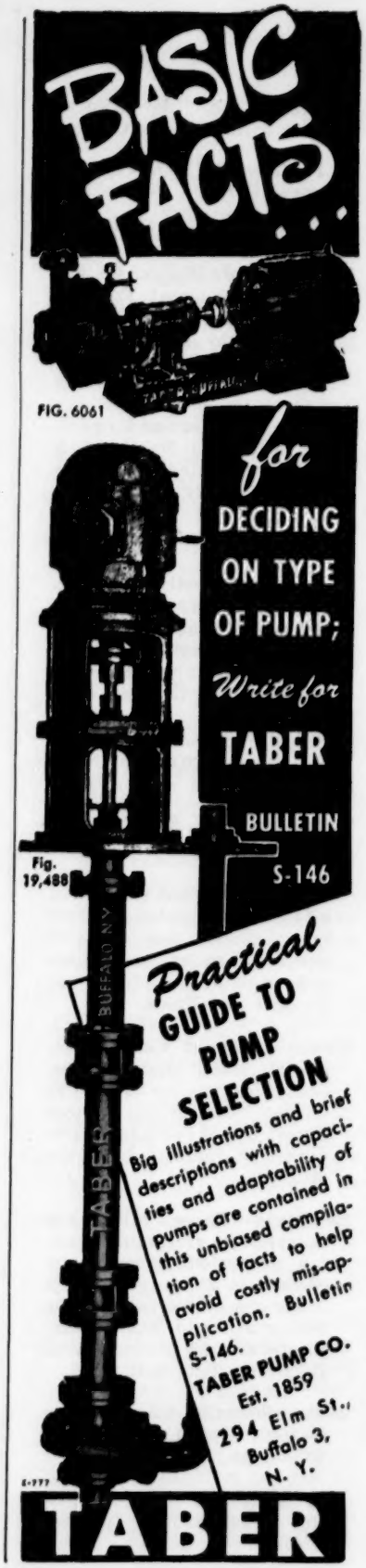
NEW COMPANIES

Nuclear Chemical Co., Chicago, has been formed to manufacture organic compounds tagged with radioisotopes of carbon, hydrogen, phosphorus or sulfur.

NEW REPRESENTATIVES

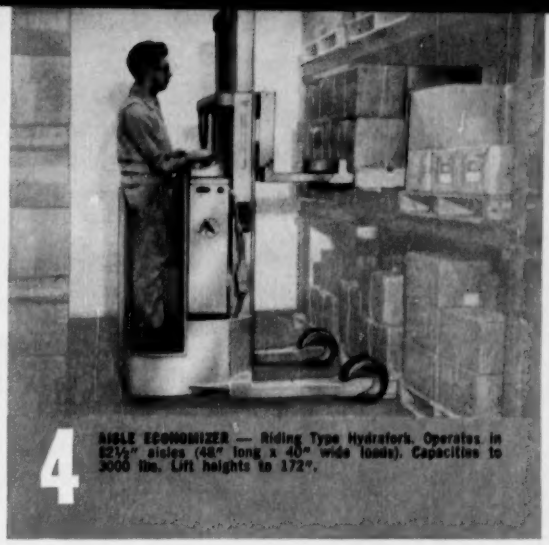
Elliott Co., a subsidiary of Carrier Corp., has licensed Consolidated Pneumatic Tool Co., London, to manufacture Lagonda tube cleaners and related equipment.

Ontor, Ltd., Toronto, Ont., has been appointed distributor for Ledeen cylinders, valves, hydraulic air pumps and boosters, manufactured by Ledeen Mfg. Co.





1 **AISLE COMPRESSOR**—Platform Type JackStacker. Operates in 69" aisles (48" long x 40" wide loads). Capacities to 6000 lbs. Lift heights to 150".



4 **AISLE ECONOMIZER** — Riding Type Hydrafork. Operates in 82½" aisles (48" long x 40" wide loads). Capacities to 3000 lbs. Lift heights to 172".



5 **SPACE MASTER** — Model "MN". Operates in 78" aisles (48" long x 40" wide loads). Capacities to 3000 lbs. Lift heights to 198".

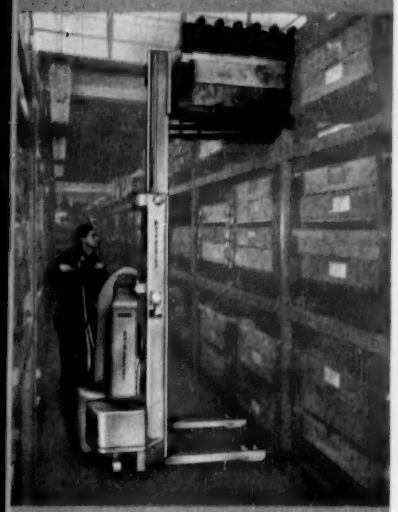
6 ways to narrow aisles... expand your storage or production areas

Each of the space-saving, money-saving Lewis-Shepard Electric Trucks shown here can operate easily in 7-foot aisles, or less

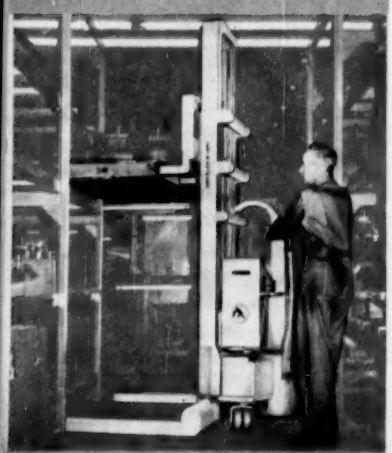
Want to put unused storage space to use? Let the rugged, smooth-operating Lewis-Shepard electrics illustrated here help you. Differing in detail, nevertheless they all have *one thing* in common . . . aisle-saving compactness. By reducing existing aisles, Lewis-Shepard equipment has created thousands of extra cubic feet of storage area without laying a brick.

Beside compact construction, other practical advantages common to L-S trucks include . . . lifetime lubrication, which ends forever the need for greasing; roller masts, eliminating friction wear; gear drive, which means no chains to break — no clutch to wear; magnetic controls, to provide instant speed selection and braking.

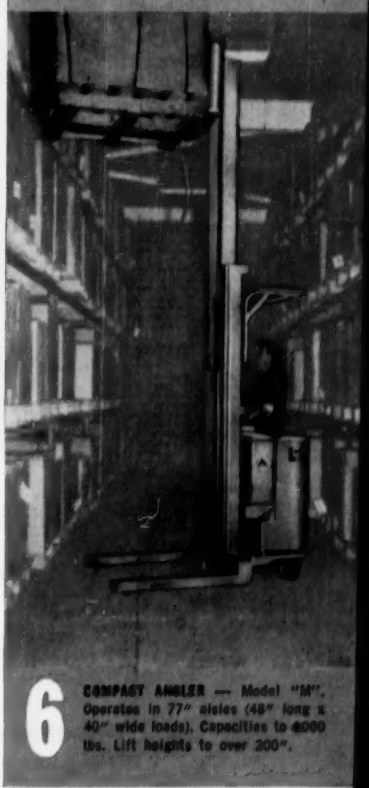
Lewis-Shepard, manufacturer of the most complete line of industrial trucks, anywhere, offers you power-tiering equipment in either rider, or walkie types — each a leader in its special field. For catalogs on trucks shown here, mail coupon.



2 **NARROW-AISLE WALKIE** — Open-Faced Pallet Type JackStacker. Operates in 69" aisles (48" x 40" long loads). Capacities to 6000 lbs. Lift heights to 125".



3 **HIGH STACKER** — Straddle Type JackStacker. Operates in 72" aisles (48" long x 40" wide loads). Capacities to 6000 lbs. Lift heights to over 200".



6 **COMPACT ANGLER** — Model "M". Operates in 77" aisles (48" long x 40" wide loads). Capacities to 6000 lbs. Lift heights to over 200".

Use coupon below for further information on Narrow-Aisle LEWIS-SHEPARD Trucks

MULTIPLY MANPOWER · LEWIS-SHEPARD

LEWIS-SHEPARD

The Master Line

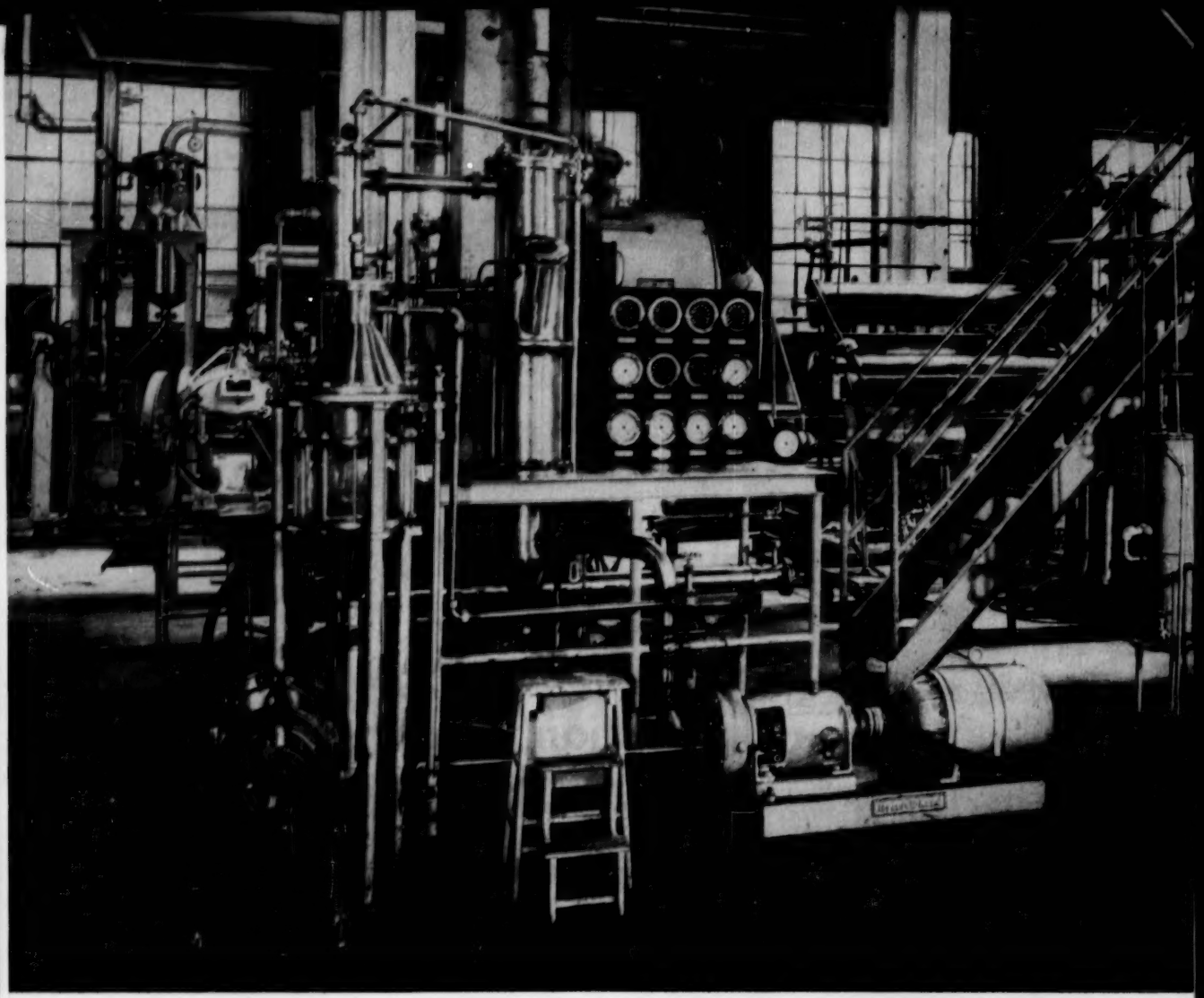
5718 Walnut Street, Watertown 72, Mass.

Send me catalogs on L-S Narrow-Aisle Trucks.

NAME .....

COMPANY .....

ADDRESS .....



Buflovak puts the best equipped processing lab at your service

Buflovak laboratory has solved over 7000 processing problems. This thorough research, conducted by an experienced staff of skilled engineers, has lead to many new methods now in use in the chemical, food, pharmaceutical and allied fields.

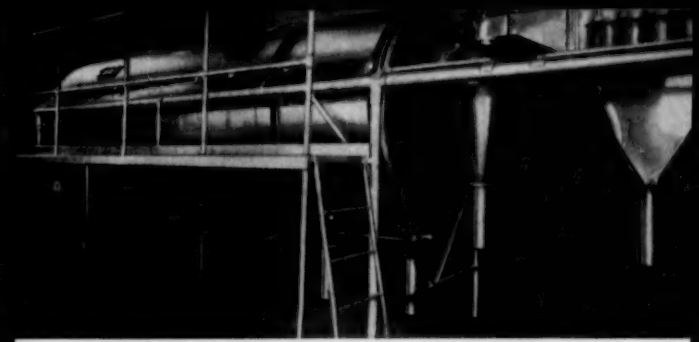
Buflovak's research and development center is noted for its completely equipped processing laboratory for investigating drying, evaporation, extraction, impregnation, crystallization and other related processes.

Here you can obtain accurate performance data on your product . . . examine your process efficiency . . . explore by-product possibilities. Whether you test a few beakers of precious material or run tank car quantities on a round the clock production scale, you get proof positive on the operation.

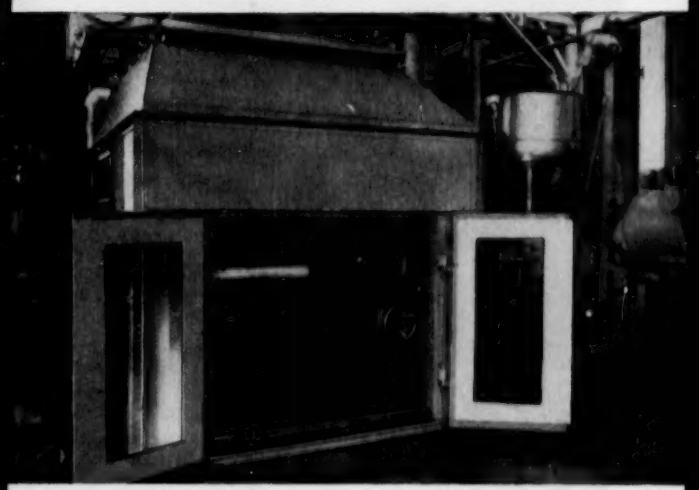
Buflovak laboratory is a complete processing plant equipped with a variety of small experimental units and semi-plant size equipment. New models are continually installed, so that the testing apparatus is always the latest obtainable.

Constant research makes Buflovak designs the most modern in the field, the most dependable in operation. Because Buflovak builds a complete line of processing equip-



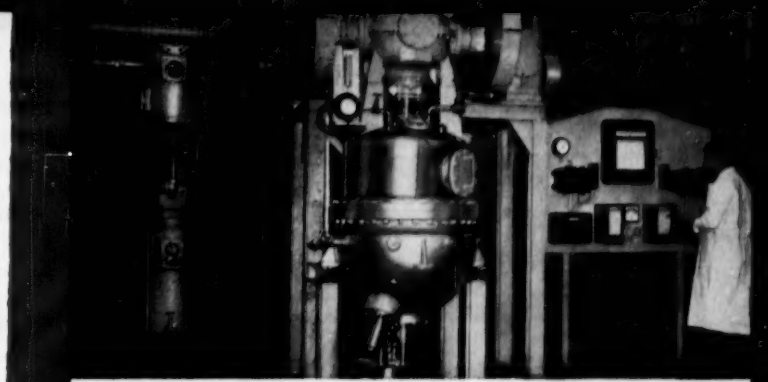


When experimenting with high recovery of solids, this pilot plant Spray Dryer is often used. Instantaneous drying from liquid to dry product provides new product characteristics, opens up new markets for chemical, pharmaceutical and food manufacturers. Noted for its low initial cost, Buflovak Spray Dryers assure low maintenance costs.



How to handle dusty or toxic materials is another aspect of Buflovak research. Dyes, herbicides and other materials can cause serious dust and fire hazards, often release toxic solvents. Buflovak enclosed Double or Twin Drum Dryers have been found to offer complete safety against these dangers, and to permit the reclaiming of important solvents.

▲ **Testing evaporation.** This Forced Circulation Evaporator (above at left) is used to concentrate heavy liquids. Buflovak evaporators are designed to fulfill a particular application . . . to provide a virtually complete recovery of solids . . . to produce a finished product suited to market and process requirements.



Concentrating, mixing, reacting and many other processes are checked in this 50-gallon Stainless Steel Processing Kettle. Tests can be run at atmosphere, under pressure or at full vacuum. It is equipped with a double motion agitator with separate variable speed drives for each agitator element.

ment—such as evaporators, dryers, kettles, autoclaves and flakers—it can impartially recommend the units that sound research indicates the best.

Take advantage of Buflovak's 50 years experience. Your engineers are invited to consult our staff without obligation.

For details, write for Catalog 358.

BLAW-KNOX

BLAW-KNOX COMPANY

Buflovak Equipment Division

1551 Fillmore Avenue, Buffalo 11, N. Y.

Buflovak puts the best equipped processing lab at your service

Buflovak laboratory has solved over 7000 processing problems. This thorough research, conducted by an experienced staff of skilled engineers, has lead to many new methods now in use in the chemical, food, pharmaceutical and allied fields.

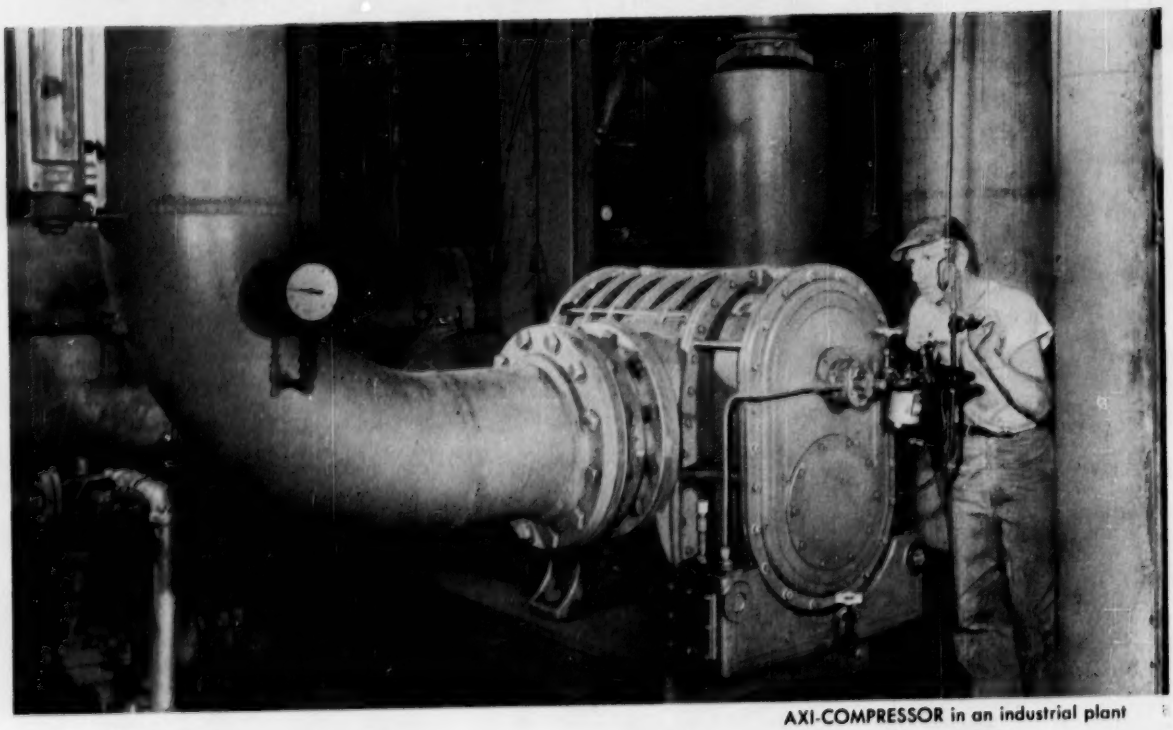
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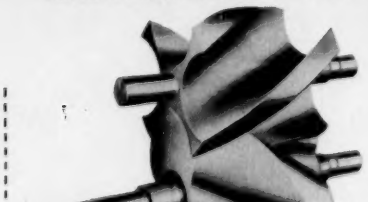
Most compact compressor of its type . . .



AXI-COMPRESSOR in an industrial plant

Use the

*Axi-compressor**

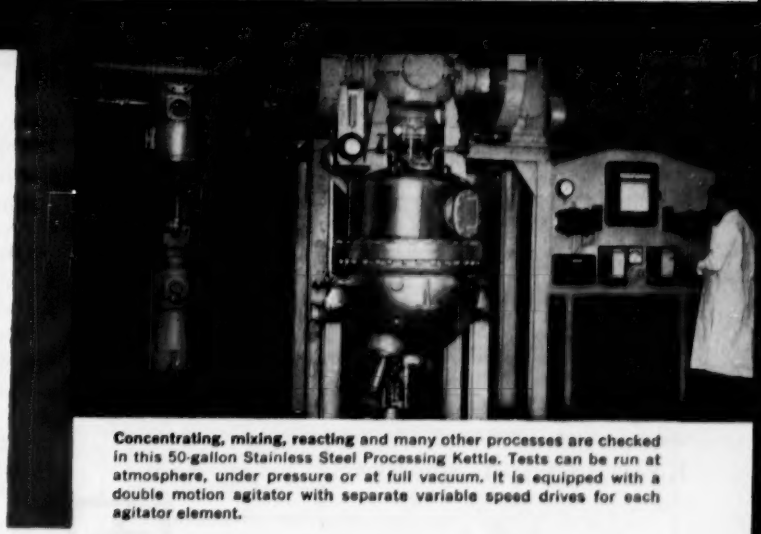


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Take advantage of Buflovak's 50 years experience. Your engineers are invited to consult our staff without obligation.

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Concentrating, mixing, reacting and many other processes are checked in this 50-gallon Stainless Steel Processing Kettle. Tests can be run at atmosphere, under pressure or at full vacuum. It is equipped with a double motion agitator with separate variable speed drives for each agitator element.

BLAW-KNOX

BLAW-KNOX COMPANY

Buflovak Equipment Division
1551 Fillmore Avenue, Buffalo 11, N. Y.

Remarkable resistance to heat and harsh chemicals

PROPERTIES OF "ARMALON" FELTS

GENERAL

Highly resistant to strong acids and bases at all temperatures.

Unaffected by water, common fuels, lubricants, hydraulic fluids, solvents.

High anti-stick properties.

Low coefficient of friction.

For FILTERING MATERIALS—tetrafluoroethylene felts

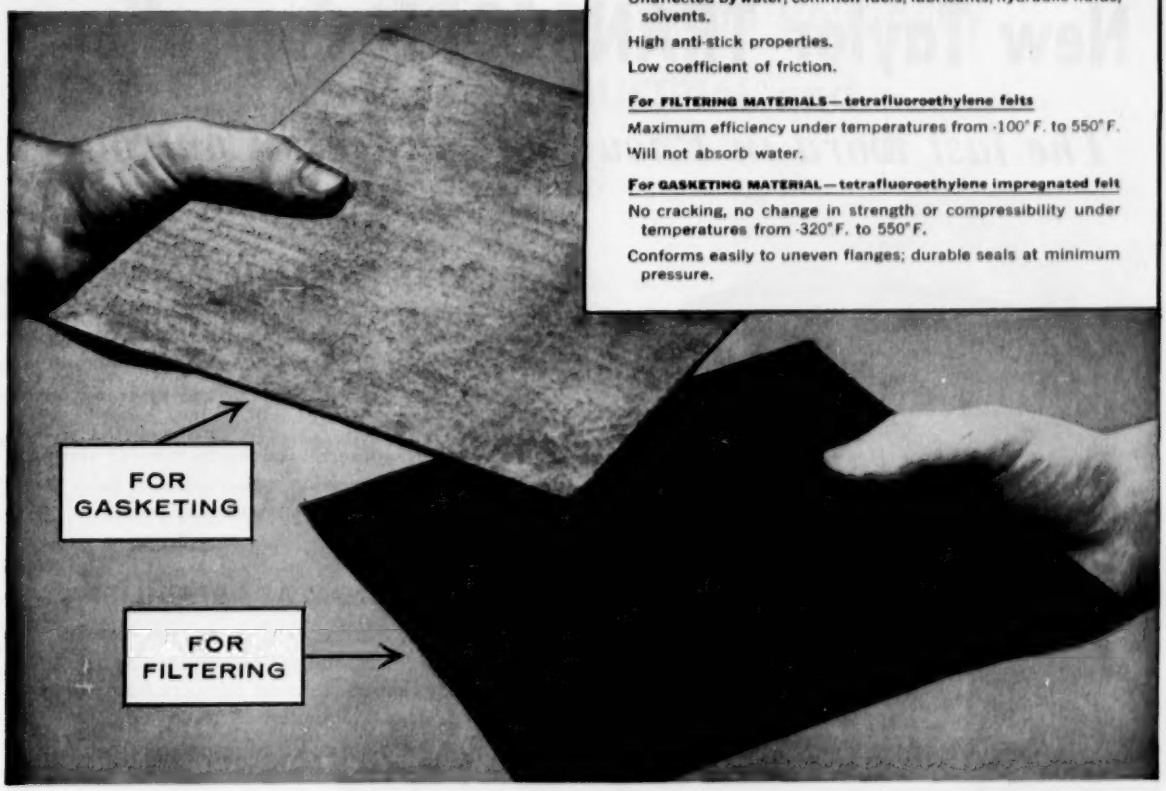
Maximum efficiency under temperatures from -100° F. to 550° F.

Will not absorb water.

For GASKETING MATERIAL—tetrafluoroethylene impregnated felt

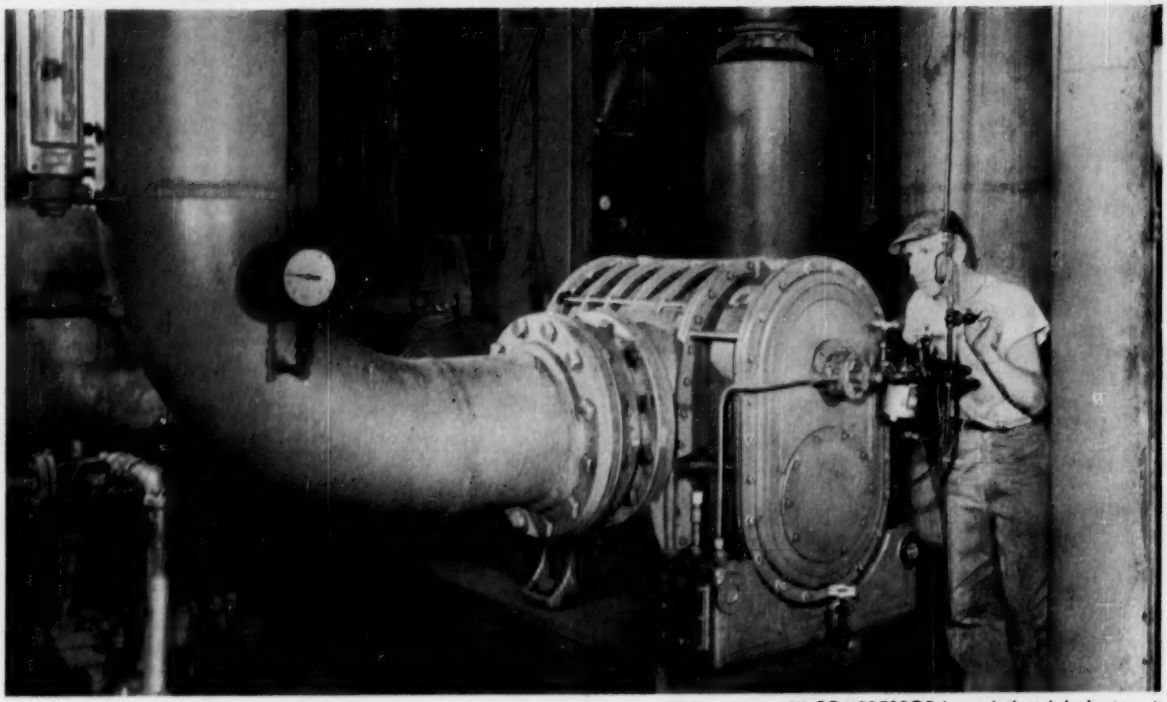
No cracking, no change in strength or compressibility under temperatures from -320° F. to 550° F.

Conforms easily to uneven flanges; durable seals at minimum pressure.



New ARMALON® felts show exceptional service life

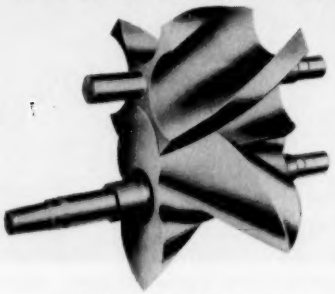
Most compact compressor of its type . . .



AXI-COMPRESSOR in an industrial plant

Use the Axi-compressor*

for pressure and vacuum . . . for air, gases, vapors



Rotors of Axi-Compressor

If you are looking for a compact, efficient source of pressure or vacuum, investigate AXI-COMPRESSORS: they provide greater output per pound of unit. AXI-COMPRESSORS may be operated efficiently over a wide range, with low power consumption.

Rotors are of cycloidal form, screw type. They operate with clearances of a few thousands of an inch, but never touch . . . there's no need for internal lubrication.

Operating advantages of this axial-flow, positive-displacement unit includes the following:

1. Compact, rugged construction
2. Smooth, shockless flow
3. No metal-to-metal contact in compression chamber
4. Operating speeds that permit direct-connected drivers in many cases
5. Oil-free delivery
6. Good efficiency over wide range

For complete information on the AXI-COMPRESSOR line for pressures from 25-inch vacuum to 15 psi, capacities from 100 cfm to 15,000 cfm . . . contact your Ingersoll-Rand compressor specialist. Performance curves available in Bulletin 11,001 . . . write for it.

*Axi-compressor
. . . formerly "Standardaire"

17-663

Ingersoll-Rand
11 Broadway, New York 4, N. Y.

PUMPS • CENTRIFUGAL & RECIPROCATING COMPRESSORS • DIESEL ENGINES • AIR & ELECTRIC TOOLS • TURBO BLOWERS • STEAM CONDENSERS

Remarkable resistance to heat and harsh chemicals

PROPERTIES OF "ARMALON" FELTS

GENERAL

Highly resistant to strong acids and bases at all temperatures.

Unaffected by water, common fuels, lubricants, hydraulic fluids, solvents.

High anti-stick properties.

Low coefficient of friction.

For FILTERING MATERIALS—tetrafluoroethylene felts

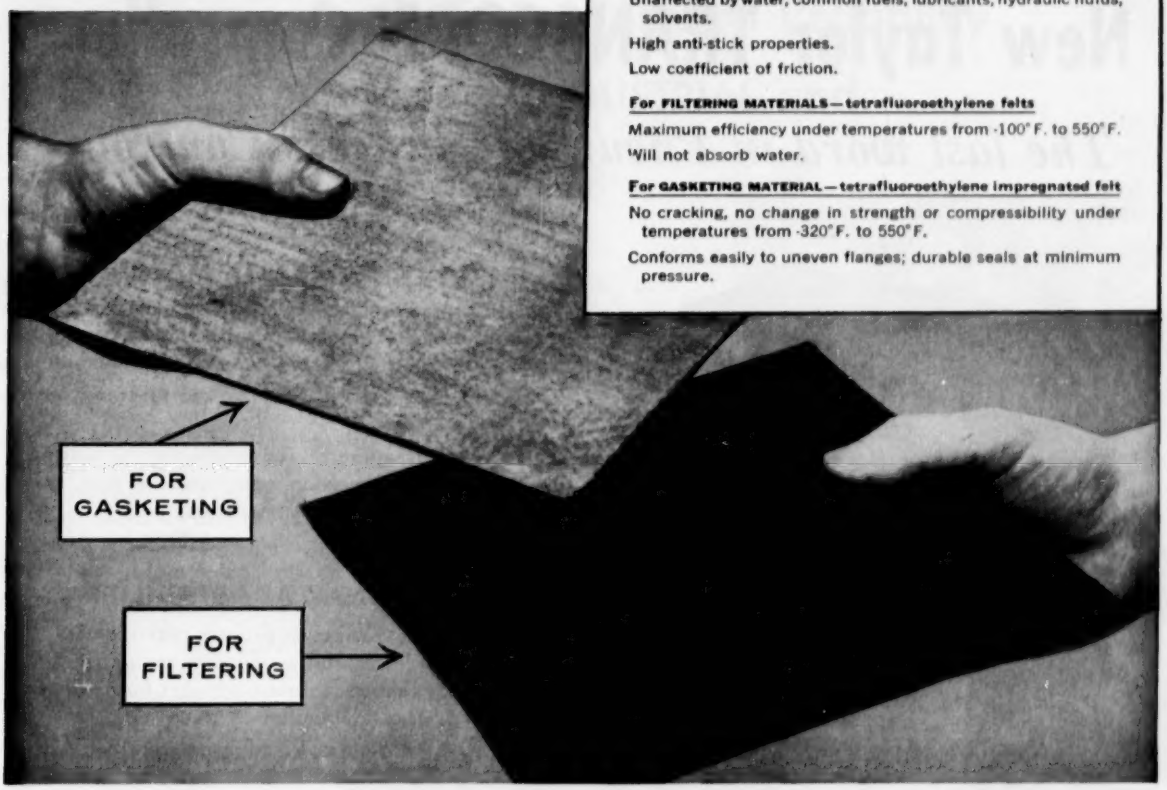
Maximum efficiency under temperatures from -100°F. to 550°F.

Will not absorb water.

For GASKETING MATERIAL—tetrafluoroethylene impregnated felt

No cracking, no change in strength or compressibility under temperatures from -320°F. to 550°F.

Conforms easily to uneven flanges; durable seals at minimum pressure.



New ARMALON® felts show exceptional service life in strong corrosives, temperatures up to 550° F.

Corrosion-resistant filters and gaskets of new "Armalon"* tetrafluoroethylene resin assure extraordinary long life felts where other materials fail entirely. They've proved their superiority in systems handling strong acids and bases—at temperatures from -320°F. to 550°F.

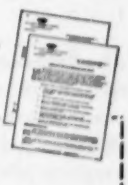
"Armalon" is the new felted form of Du Pont's "Teflon"** tetrafluoroethylene resin, available in two constructions—one for filtering, the other impregnated for gasketing†. "Armalon" is inert to water, common fuels, lubricants, hydraulic fluids, solvents and corrosive chemicals.

FILTERS of "Armalon" remove fine particles at high flow rates with minimum pressure drop. Anti-stick property of "Armalon" means longer service life, easier cleaning.

GASKETS of "Armalon" seal securely and last months, even years, longer than other materials. Advantages include substantial reductions in costly replacement shutdowns.

For more facts that may help you find a place for "Armalon" felts in your operations, fill out and mail the coupon. You'll receive Du Pont's free descriptive bulletin, including specifications.

*"Armalon" is Du Pont's registered trademark for its tetrafluoroethylene felts and impregnated felts.
**"Teflon" is Du Pont's registered trademark for its tetrafluoroethylene fiber.
†"Armalon" tetrafluoroethylene impregnated felt is covered by U. S. Patent 2,764,506.



DU PONT INDUSTRIAL COATED FABRICS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

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Wilmington 98, Delaware

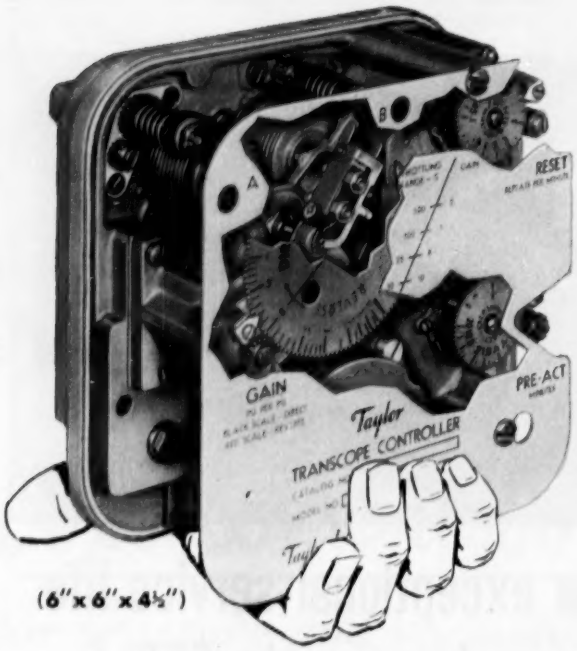
Please send me descriptive bulletin on "Armalon" felts.

Name_____ Position_____
Company_____
Address_____
City_____ State_____

NEW IN PRINCIPLE . . . NEW IN DESIGN . . . NO EQUAL IN PERFORMANCE!

New Taylor TRANSCOPE* Controller

The last word in Pneumatic Process Control



(6"x 6"x 4½")

SUPERIOR PERFORMANCE

1. Especially suited for short spans of measurement . . . ideal for time constants of modern processing . . . outstanding in insensitivity to ambient temperatures.

2. Exceptionally fast and responsive to adjustments —vital on start-ups.

3. Accurate pre-determined mathematical settings made possible by precision manufacture of gain, reset and PRE-ACT* units. Adjustments stay put.

EXCEPTIONAL ADAPTABILITY

1. Adaptable to changes in process requirements . . . complete interchangeability of components so you can convert from simplest to most complex forms of control *in the field* . . . in minutes.

2. Instrument action reversed by merely rotating a dial. Plugs into TRANSET* Indicators and Recorders or locally mounted manifolds.

3. Designed to meet the demand for more compact instruments, it is ideally suited for use in graphic panels and scanning and logging systems.

SIMPLE MAINTENANCE

1. Rugged bellows assembly, keyed in place, moves the dynamically balanced force plate . . . friction-free bending member never needs maintenance.

2. Husky die-cast aluminum assemblies, accessible stainless steel nozzle and baffle, hardened stainless steel reaction members. Dust and moisture-proof case.

3. Ease of alignment—smooth-acting, screw-driver adjustment because of ball bearing construction.

4. Easy to understand . . . easy to get at . . . simplifies maintenance training.

5. Integral cut-off relay is a built-in feature.

*Trade-Mark

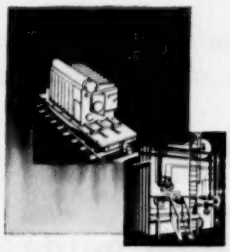
The **Transcope Controller** is so compact, so simple, so smooth and responsive to adjustments yet so accessible for every purpose that it really "gets" you. But the "pay-off" doesn't come until you put it on your toughest job. Only then can you realize how contagious enthusiasm can become.

▼ ▼ ▼

Write for **Bulletin 98278.** Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST

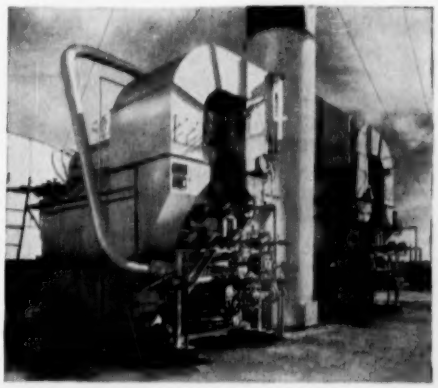
VISION · INGENUITY · DEPENDABILITY



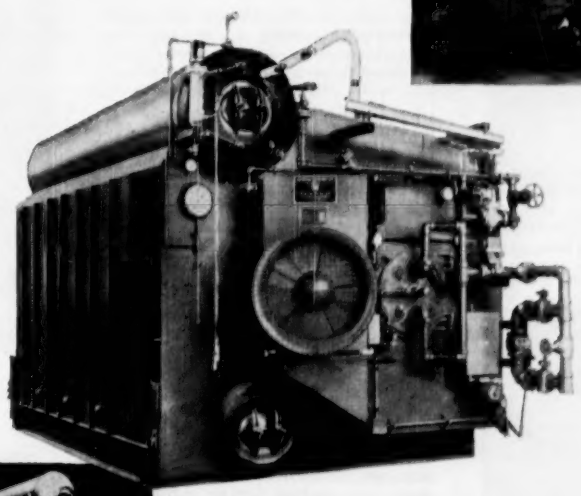
HEAT ENGINEERING by FW

extends Central Station Reliability to Standard INDUSTRIAL and PACKAGED UNITS

PACKAGED STEAM GENERATORS of the water-tube type were introduced by Foster Wheeler in 1940 — combining in a single, compact, shop-assembled unit, all the necessary facilities for the dependable and economical generation of industrial steam. Continual research and development have resulted in further improvements in design and construction, and today the FW line of Packaged Steam Generators, in capacities from 10,000 to 60,000 lb/hr, represents the last word in modern steam plant design, reflecting over half a century of service to the power generation industry. Features include 36″ steam drum and 24″ water drum, staggered boiler tubes, closely spaced waterwall tubes, water-cooled target wall, and wide choice of burners and controls.

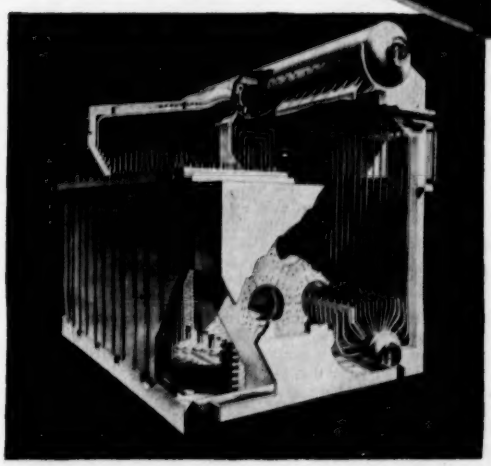


Above: Two FW packaged boilers — the first ever offered to industry — were installed for oil field drilling operations in 1940. They are still in service, delivering low-cost steam.



Left: New Foster Wheeler series AG-100 Packaged Steam Generator.

Cutaway view of typical FW Standard Steam Generator.



STANDARD PRE-ENGINEERED UNITS by Foster Wheeler offer all the advantages and economies of *standardization* for larger industrial steam generators of from 50,000 lb/hr to 450,000 lb/hr capacity. The new FW line of "SC" and "SD" standard units is heat engineered to the same standards of dependability and performance which have made Foster Wheeler steam generators first choice in many of the leading central station plants throughout the country. Features include completely water cooled walls, efficient firing arrangement, fully drainable superheater, high steam purity, unrestricted circulation, pressure-tight construction and minimum refractory baffling. For further details, send for Bulletin B-55-4.

FOSTER FW WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

BRIEFS FOR BUYERS

about Solvents • Sodium Sulfide • Caustic Soda • Sodium Benzoate •

What do you dissolve?

Any discussion of industrial solvents would be incomplete without at least a mention of *trichlorobenzene, tech.*

This versatile material, as we produce it, is a mixture of the 1,2,4- and 1,2,3- isomers of trichlorobenzene. A clear, almost colorless mobile liquid, it typically distills within 5°C between the limits of 213° and 219°C. Like most Hooker solvents, it is nonflammable.

For dissolving fats, oils, waxes, and certain resins, and as a crystallization solvent, it offers several specific advantages which we'd like to discuss with you one of these days.

In the meantime, in case you are not aware of the variety of special-purpose solvents you can get from Hooker, here's a partial list, at right, showing specifications to which they are made.

If you'd like more data on their properties, ask your Hooker salesman, or clip the coupon.

Solvent	Formula	Hooker specifications		
		Freezing Point	Dist. Range	Sp. Gr.
Cyclohexanol: high grade tech. grade*	$C_6H_{11}OH$	18°C min. 10°C max.	100% within 159° to 163°C 85% within 1.5°C incl. 161.7°C	0.944±.0015** 0.939±.0015**
***ortho*-Dichlorobenzene**	$C_6H_4Cl_2$	−18°C max.†	4°C incl. 179.5°C	1.313±.003††
Methyl Cyclohexanol	$CH_3C_6H_{10}OH$	Note‡	155° to 180°C	0.924±.003††
Monochlorobenzene	C_6H_5Cl	−44°C (typical)	1.0°C incl. 132.0°C	1.113±.001††
Monochlorotoluene	$CH_3C_6H_4Cl$	−28°C† (typical)	158° to 165°C	1.080±.005††
Trichlorethylene: tech. grade extraction grade	$CHCl{=}CCl_2$	−86.4°C (typical)	86.6° to 87.8°C 86.6° to 87.4°C	1.469±.002§ 1.474±.002§
Trichlorobenzene	$C_6H_3Cl_3$	10°C max.	5°C incl. 216°C	1.467±.007††

*Includes 2.5% methanol by weight to depress freezing point. †Last crystal point.
††15.5°/15.5°C ‡Becomes glass-like below room temperature. §15°/4°C **25°/15.5°C



Sulfides in new drum easier to empty or re-use in your plant

Your operators will like the convenience of this new 400-lb. drum in which you can now purchase Hooker sodium sulfide and sodium sulfhydrate.

The opening is 18 inches in diameter —4 inches wider and 65% larger in area than the former container.

This drum is much easier to empty with a scoop or shovel. It saves time and is safer when pouring, too. Flakes don't pile up around the opening when drum is inverted.

You'll also like the way this drum safeguards the exceptionally low iron content of our sulfide or sulfhydrate until you're ready to use it.

Only brand-new drums are shipped; none are re-used. A lacquer lining prevents iron pickup during shipping and storage. Six lugs hold the lid on tight, and let you reseal the drum to protect any unused product.

There's no increase in price for the new drum. To get its extra convenience and safety, just specify *Hooker* sodium sulfide or sodium sulfhydrate on your next order.

Phosphorus pentasulfide: old horse, new blanket

Combine elemental phosphorus with sulfur—as we have been doing for more than 50 years—and you get some interesting results.

One of them is *phosphorus pentasulfide*, P_2S_5. This chemical was first developed in this country to make flotation reagents for copper ore. A considerable volume of it goes into special motor oil additives.

Most recently, it is helping to raise the curtain on a new field of synthesis —phosphorus-containing insecticides.

To assure good supply and fast service, we make phosphorus pentasulfide in two plants—at Niagara Falls, N. Y., and Columbus, Miss. It's available as powder in three different particle sizes, and as a fused solid. Phosphorus content is 27.8% minimum.

For current technical data sheet, check the coupon.

40-page manual tells how to handle caustic soda

Written for engineers, a new 40-page Hooker manual sums up newest techniques for handling and storage of liquid caustic soda.

Contents include detailed diagrams of equipment; a section on materials of construction; recommendations for unloading, diluting, piping, and storage; and a section on safety precautions and first aid.

For a copy, check the coupon for Hooker Bulletin 102, *Caustic Soda Engineering and Handling Guide.*

Quick-dissolving sodium benzoate

Every now and then we run into someone who's having a tough time dissolving powdered sodium benzoate into process.

Sodium Sulfhydrate • Phosphorus Pentasulfide

Muriatic Acid • Other Chemicals

Like many fine powders, this form of sodium benzoate does occasionally give trouble by balling when it gets wet.

If this happens in your process, you can stop it for good—with Hooker *flake* sodium benzoate. As you see here, this fine flake form starts dissolving in water almost instantly.



Thanks to an unusually careful flaking-screening operation, the Hooker flake stands shipping well—won't dust.

If you'd like to see how this quick-dissolving flake can speed your operations, order a trial drum now. *U.S.P. grade* is 99+% pure; contains a max. of 0.2% benzoic acid, 0.5% water. *Technical grade* is also a high-quality material at 98%, with 0.4% benzoic acid max., and the remainder water.

You can get either grade in powder form, too. For complete technical data, check the coupon.

Is the wrong kind of muriatic giving your process indigestion?

Just look at some of the things that can happen when the muriatic acid you buy isn't quite as good as it should be for your process.

If you're making benzidine dyes, for example, you know that *sulfates* in muriatic acid can gum up your equipment with an insoluble white precipitate.

In refining certain high-grade metals, such as radium, sulfates can cause serious extraction losses. Sulfates are bad actors, too, in processing many food and vitamin products.

Iron, another impurity sometimes present in muriatic acid, can make a product that should be white come out yellow.

Arsenic, present in some acids, can cause trouble, including formation of toxic arsine gas during metal pickling.

Finally, *free chlorine* in muriatic can give your production men headaches by helping to oxidize valuable components in the batch.

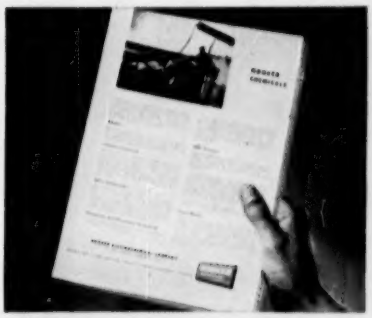
WHAT TO DO ABOUT IT: This brings us to the reasons why *your* process, if it's sensitive to any of the impurities mentioned above, will perk most efficiently when you feed it Hooker White muriatic.

Hooker White is just about the purest muriatic acid you can buy in commercial volume. It contains a mere 0.0001% iron as maximum; only 0.003% sulfates; *no* free chlorine; *no* arsenic.

If your processing requirements are only slightly less rigid than these, you'll want to get acquainted with another member of the family: Hooker Commercial Grade muriatic. This grade contains only 0.0005% iron; 0.003% sulfates; a trace of free chlorine; no arsenic.

You can get either grade in 13-gallon carboys or in rubber-lined tank cars, in three strengths: 18°, 20°, 22° Baumé. For technical data check the coupon.

If you'd like samples of either grade, please drop us a line on your business letterhead.



New 12-page bulletin lists Hooker products

You'll find a complete listing of Hooker chemicals in this new bulletin. Indexed for ready reference, it includes under each product a short description and listing of properties, actual and suggested uses, and shipping containers. The bulletin also sums up major types of processing performed at Hooker. For your copy, just check the coupon for *Bulletin 100-A.*

For more information on chemicals mentioned on this page, check here:

- ☐ Trichlorobenzene, tech.
- ☐ Cyclohexanol
- ☐ *ortho*-Dichlorobenzene
- ☐ Methyl Cyclohexanol
- ☐ Monochlorobenzene
- ☐ Monochlorotoluene
- ☐ Trichlorethylene
- ☐ Sodium Sulfide
- ☐ Sodium Sulfhydrate
- ☐ Phosphorus Pentasulfide
- ☐ Caustic Soda (data sheet)
- ☐ Bulletin 102, *Caustic Soda Engineering and Handling Guide*
- ☐ New list of products—Bulletin 100-A
- ☐ Sodium Benzoate
- ☐ Muriatic Acid

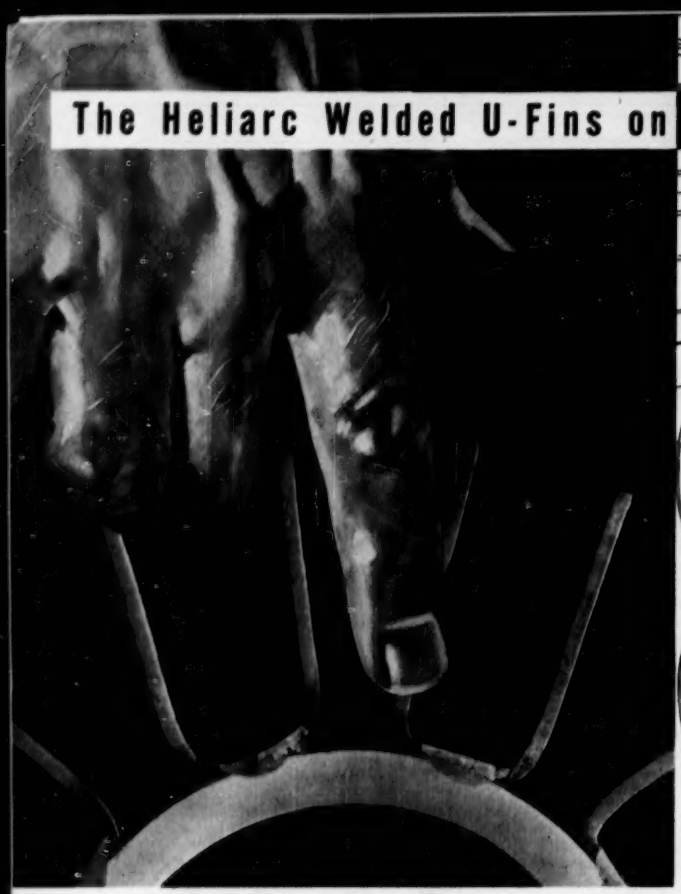
Clip and mail to us with your name, title, and company address. (*When requesting samples, please use business letterhead.)*

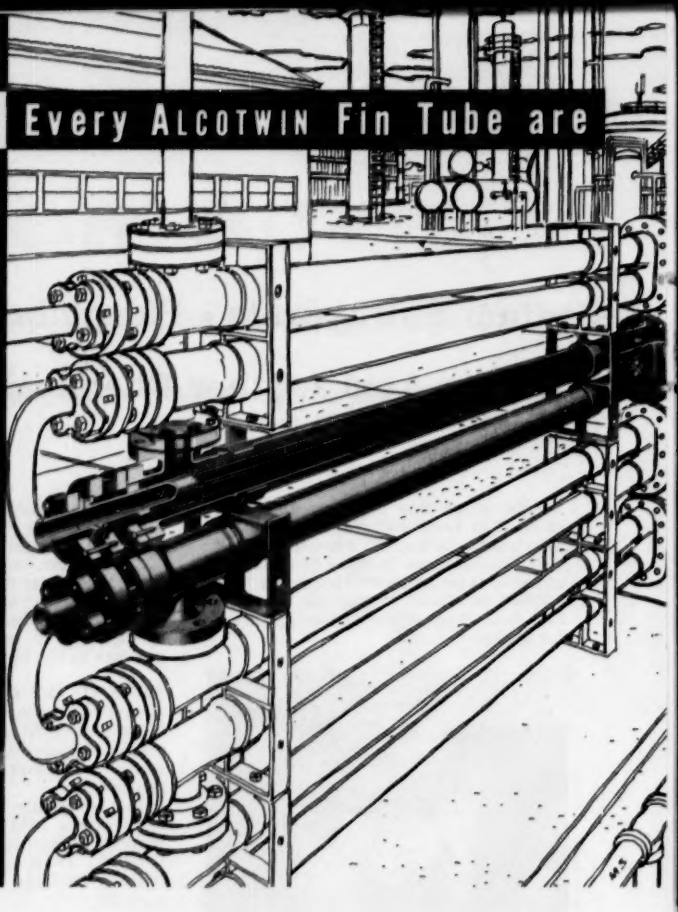
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HOOKER CHEMICALS PLASTICS





The Inside Reason for ALCOTWIN SUPERIORITY

The ALCO gas shielded tungsten arc welding method of fusing the fins to the tube leaves no discontinuities. As a result, the ALCOTWIN® heat exchanger has unequalled heat transfer efficiency. With the ALCO non-ferrous tube and fin combinations, use of intermediate high resistance bonding materials is eliminated, and design temperatures are limited only by the basic metal. This structurally strong bond assures permanent contact throughout thousands of heating and cooling cycles.

A wide range of metallurgies is available with the ALCOTWIN heat exchanger. Tubes and fins can be made of the precise materials to insure best results for your application. Combinations of carbon steel, stainless steel, low- and high-chrome alloys, non-ferrous alloys, such as Monel, Inconel, admiralty metal, cupro-nickel and copper, may be used.

There is no obsolescence with ALCOTWIN heat exchangers. They can be rearranged easily as loads and process requirements change. ALCOTWINS are in stock in Beaumont, Texas, now for immediate delivery when you need them. They are available *off the shelf* in a number of sizes, for pressures up to 600 psi and temperatures to 650° F. Pressures up to 10,000 psi and special metallurgy are available on order.

Complete information is available from any of ALCO's sales offices. For a copy of Bulletin FH-3, write Petroleum Industry Equipment Division, Dept. AW-4, P. O. Box 1065, Schenectady, New York.

ALCO

ALCO PRODUCTS, INC.

NEW YORK

Sales Offices in Principal Cities

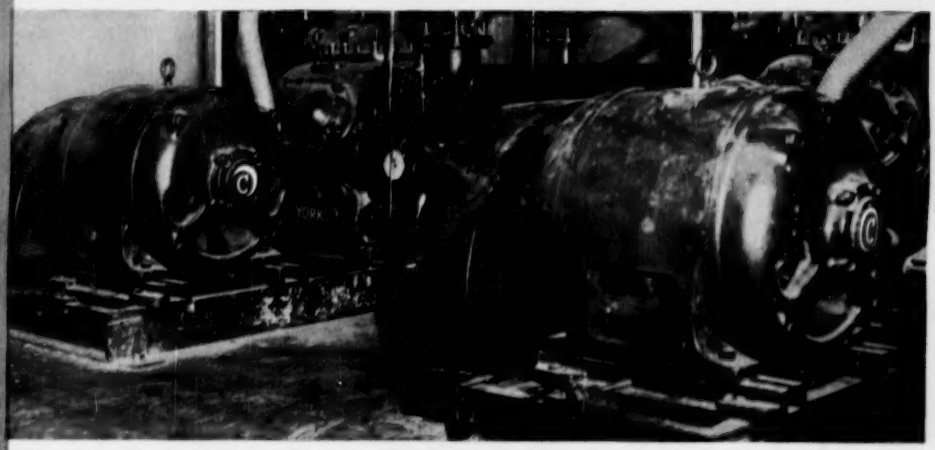
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Special low-current starting costs less WHEN YOU SPECIFY

Century PART WINDING START MOTORS

Here's the easy and inexpensive answer to having big motors that will start easily when starting current is limited. Part winding starting is available on all popular size Century motors up to 400 H.P., polyphase, in drip proof, totally enclosed and explosion proof frames, horizontal or vertical mounting.

For fast service from stock, call your nearby Century Distributor or Century District Sales Office.



Two 50 H.P. Century Part Winding Start motors power these unloading type air conditioning compressors. When starting, just half of the winding is energzied, drawing less than two-thirds of normal starting current. In a few seconds, the full winding is connected and the motor delivers full torque at full current.

Get your free copy of our bulletin: "Where Low Starting Current is Required." Mail this coupon today . . .

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MOTORS
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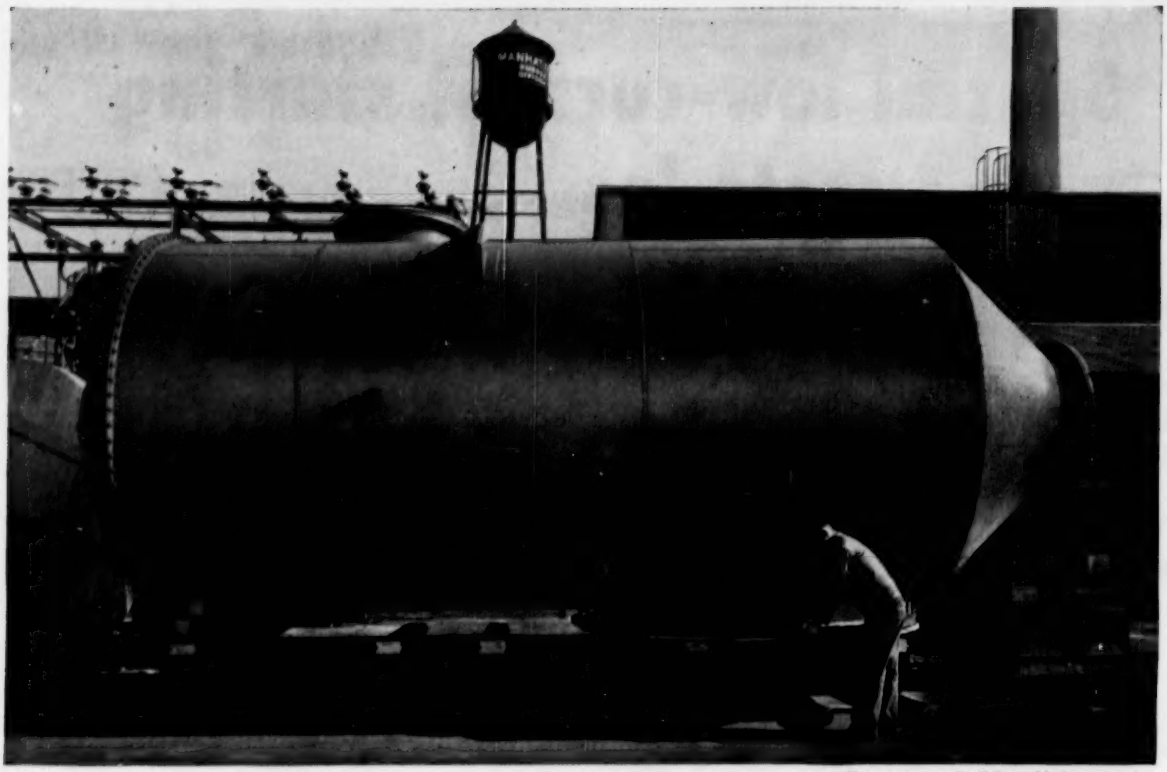


Photo courtesy, Croll-Reynolds Company, Inc.

MANHATTAN ACID-PROOF RUBBER LININGS

Protect One of the World's Largest Rubber Lined Barometric Condensers

This unit measures a big 22 feet long by 10 feet in diameter. And, because every square inch is rubber lined by Manhattan, every square inch is protected against corrosion . . . *permanently!*

Costly process equipment and solutions deserve the degree of protection against corrosion, contamination, and abrasion possible only with specially compounded, acid-proof Manhattan Rubber Linings. These linings are made from thick, multiple calendered sheets of natural or synthetic rubber for maximum durability under your specific conditions. Manhattan engineers have developed a method of bonding the rubber to the metal so securely that actual tests have proved they can't be separated! Manhattan linings expand and contract with the metal under temperature changes . . . they won't harden or crack. Resistance to most acids and alkalis is as positive as advanced technology can provide.

Equipment size or shape is no problem when you rely on Manhattan. If the unit can be shipped, it can be lined at Manhattan. Equipment too large to be shipped can be field lined and vulcanized by skilled Manhattan crews. The most modern and complete lining facilities available today, plus experience dating back to the first tank lined in this country, is ready to handle your job. To make certain your lining is flawless *and* permanent . . . every Manhattan Lined Tank is tested under high voltage.

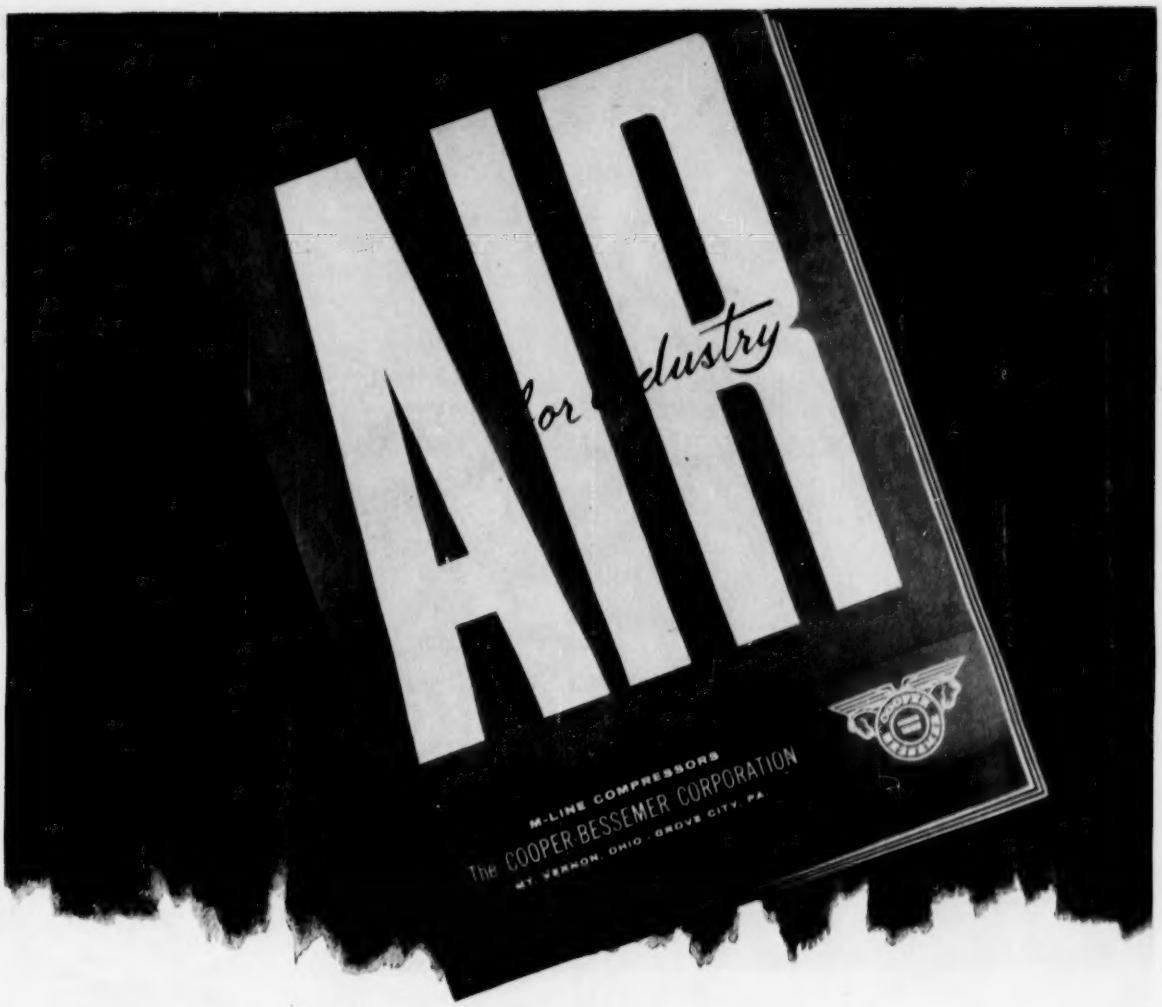
For *permanent* protection for your equipment and processes, discuss your tank lining requirements with the R/M representative at the Manhattan Rubber Lining plant nearest you . . . Write for new Tank Lining Catalog #7115. RM704

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NEW BULLETIN *on meeting the need for industrial or shop air supply*

- **Describes Cooper-Bessemer M-Line Natural Force Balance Compressors, 200 to 6,000 hp.**
- **Explains the advantageous new features developed by one of America's oldest engine and compressor builders.**
- **Simply ask for Bulletin M-81, "Air for Industry".**

The Cooper-Bessemer Corporation
Mt. Vernon, Ohio

Please send me a copy of Cooper-Bessemer Bulletin No. 81 "Air for Industry".

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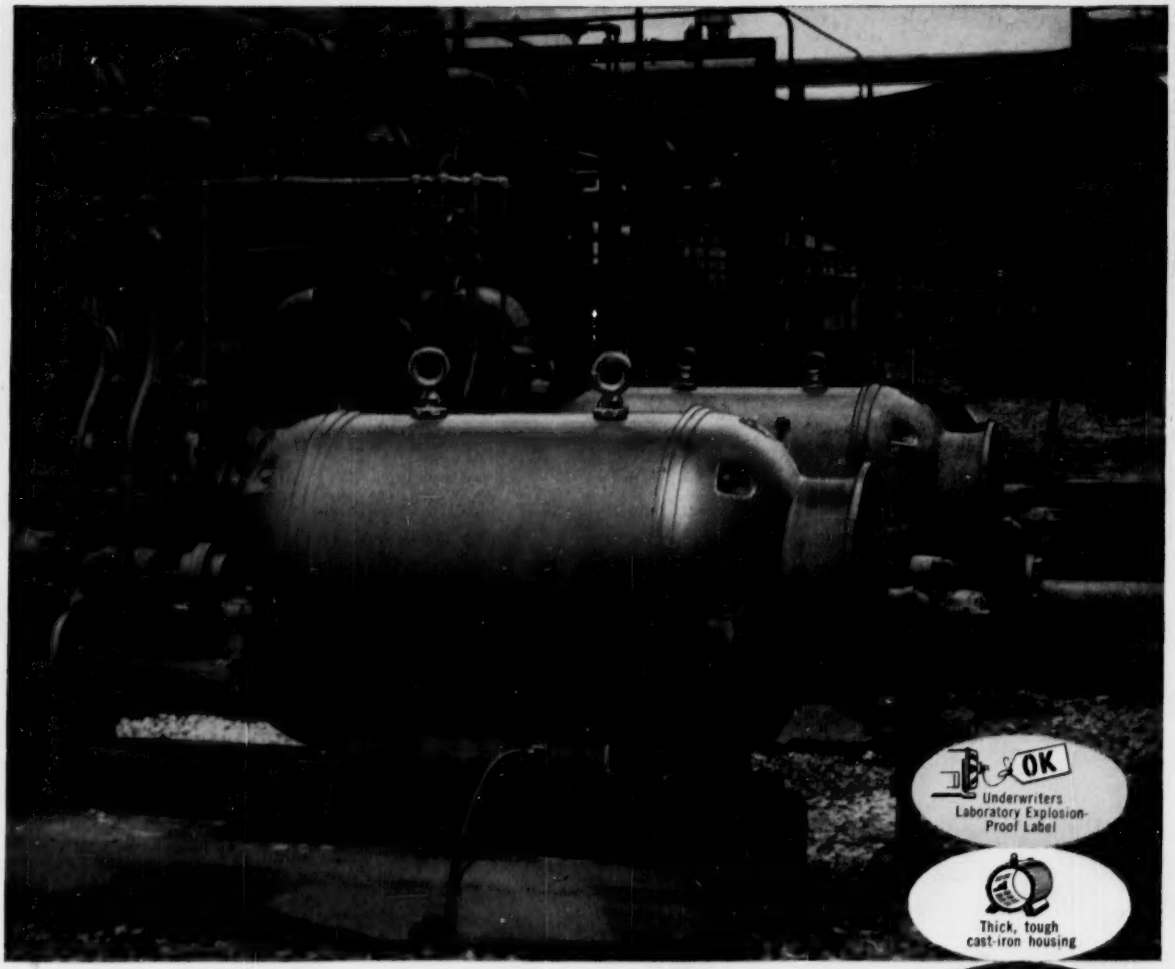
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ENGINE, MOTOR OR TURBINE DRIVEN



Tough-shelled, explosion-proof, and corrosion-resistant

New improvements in Louis Allis explosion-proof motors meet latest demands of abusive chemical service

You need tough-shelled, explosion-proof motors in the corrosive, volatile atmospheres of many of today's modern chemical processing plants.

For this rugged use, Louis Allis, the *originator* of the fan-cooled explosion-proof motor, has continued to develop new designs of direct benefit to the chemical industry: Cast-iron housings with extra-high corrosion-resistance—special varnishes that provide maximum insulation against moisture, acids, and alkali—more effective cooling with aerodynamically designed non-sparking fan.

Now, to match increasing industry demands, Louis Allis offers explosion-proof motors in the *large* sizes — up to 600 horsepower.

What's more, these motors are available in a wide range of mechanical modifications and electrical characteristics to meet many of your requirements.

See the complete story in our Bulletin 800, "Explosion-Proof Motors." Contact your Louis Allis District Office, or write today to the Louis Allis Company, 447 East Stewart Street, Milwaukee 1, Wisconsin.

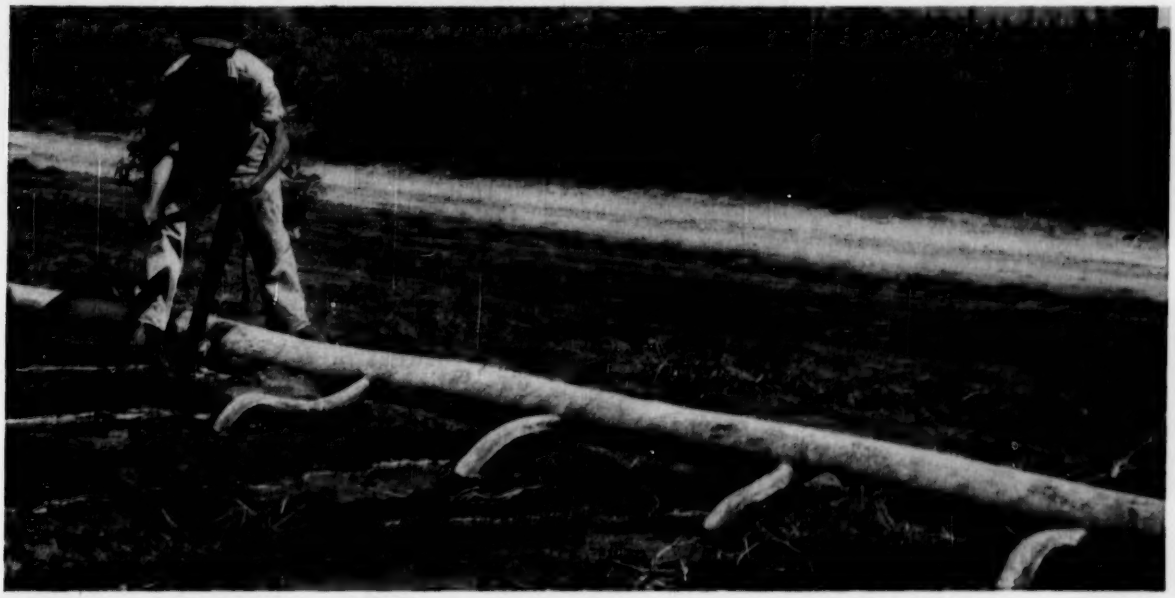
LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES





NOW! IRRIGATION THAT'S TRULY PORTABLE



AND COSTS LESS! THANKS TO ENJAY BUTYL!

Flexible irrigation "pipe" and ditch liners fabricated from Enjay Butyl rubber are helping farmers and growers conserve water by assuring maximum irrigation from available water supplies . . . ar d at *lower cost!* Combining flexibility with strength and portability, the "pipe" allows irrigation of different areas with the same equipment in a one-man carry operation. Both "pipe" and ditch liners are impervious to weather and highly resistant to soil acids and bacteria. These systems are manufactured by the Carlisle Corp., Carlisle, Pa., and are distributed by Bono Products, Inc., Taft, Texas.

Enjay Butyl may well be able to *cut costs* and *improve the performance* of *your* product! *Low-in-cost* and immediately available, this truly wonder rubber has been put to profitable use in a wide variety of industrial and consumer products. For further information, and for expert technical assistance, contact the Enjay Company.

ENJAY BUTYL

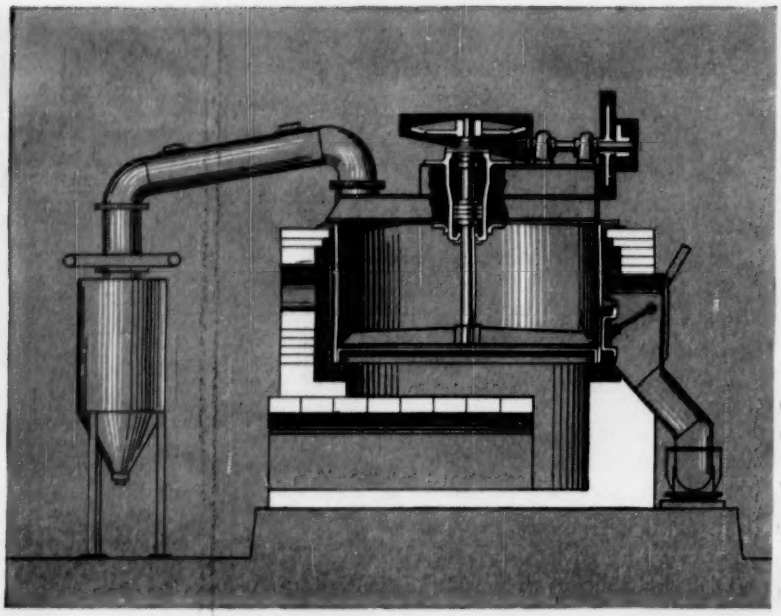
Enjay Butyl is the greatest rubber value in the world. It's the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY *Pioneer in Petrochemicals*

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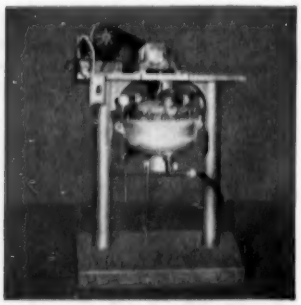
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UNDER FIRED DRYERS *for* PROCESSING URANIUM PRECIPITATES *and a wide variety of other materials*





Special Steam Jacketed Batch Dryer Showing Dust-tight Discharge Housing and Condenser.



Steam Jacketed Pot-type Dryer Fitted with Rotary Sweep.

Oil or gas fired, these batch type dryers are suited for processing at 700° F, or other temperatures beyond the range of steam,— also when steam is not available. Mild steel, stainless or alloy construction. The material is loaded through the top. A sweep agitates the charge to assure thorough, uniform processing, and discharges the material through the side door — and a dust-tight discharge housing if desired — to a screw or other type conveyor. Exhaust gases are drawn off through the top and can be passed through a condenser to reclaim the fines.

Let our heat engineering specialists, with their wide and successful experience in continuous and batch processing, work with you on your next project. We can handle all phases of the problem including complete materials handling, storage and dust collection. This assures fixed unit responsibility; the smooth synchronized operation of all parts of the installation; and utmost economy and satisfaction.

DESIGNERS ENGINEERS **BARTLETT-SNOW** CLEVELAND 5, OHIO FABRICATORS ERECTORS

DRYERS • COOLERS • CALCINERS • KILNS — *Complete Facilities Including Materials Handling*

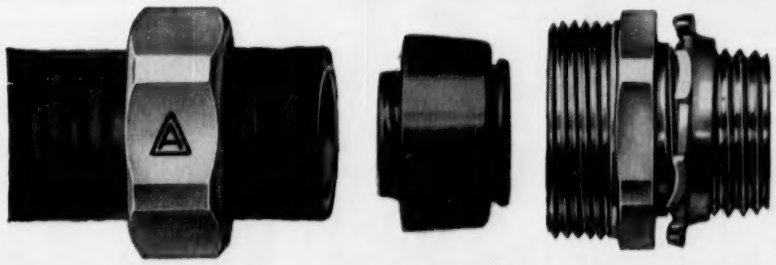
POSITIVELY EXCLUDES LIQUIDS, FUMES . . .

APPLETON

INDUSTRY'S MOST ADVANCED LINE

"ST" SERIES CONNECTORS*

for Liquid Tight Flexible Conduit



Why APPLETON "ST" Series Connectors Are Better



Precision turned compression nut (A) slips over liquid tight conduit. Brass Ferrule (B) screws into conduit with sleeve covering conduit. Tightening compression nut onto connector body (C) provides a positive seal and ground between flexible conduit and connector.



Cross section of completed connection shows how tapered end of nut compresses ferrule wall . . . seals perfectly and gives positive ground between conduit and connector.

The Only Fittings of Their Kind . . . Provide Positive Wiring System Protection

• APPLETON *"ST" Series Connectors* have an exclusive brass ferrule, and unique construction to make it your best connector buy for use with liquid tight flexible conduit! Nothing to come loose, deteriorate, crack or break. APPLETON *"ST" Series Connectors* stay tight . . . positively exclude liquids, fumes, chips, shavings and other foreign matter from electrical systems. Recommended by many electrical engineers. And, since the threaded brass ferrule screws in and crimps on there is *a perfect seal* and *permanent* ground . . . maintaining voltage in ground circuit unfailingly within 10 millivolts drop. *"ST" Series Connectors* are one more reason why APPLETON is . . .

TODAY, MORE THAN EVER . . .

The Standard for Better Wiring

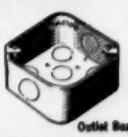
* U. S. Pat. No. 2,782,660

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Explosion-Proof Fixtures


Outlet Boxes

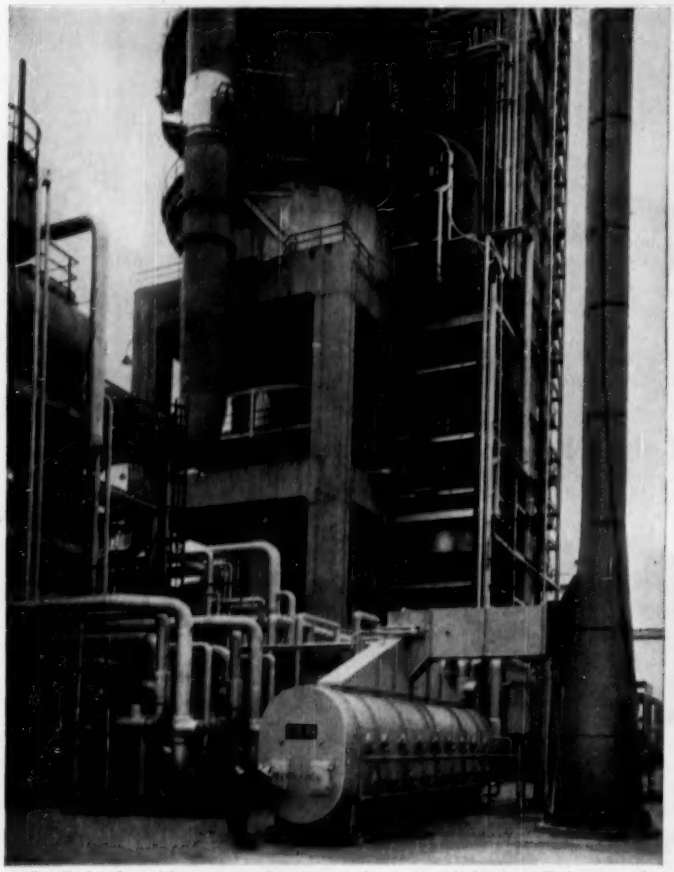

"MI" Series Connectors


Industrial Lighting

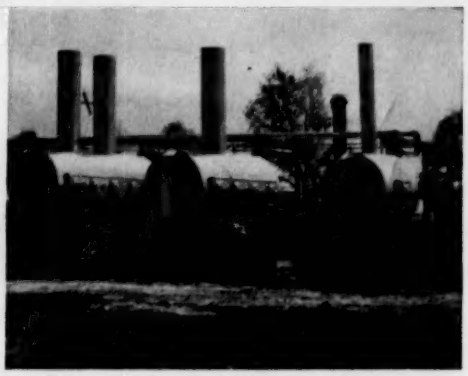

Malleable Iron Unilet Fittings

APPLETON ELECTRIC COMPANY • 1742 Wellington Avenue • Chicago 13, Illinois

Small Gradiation® Heaters do a Big Job

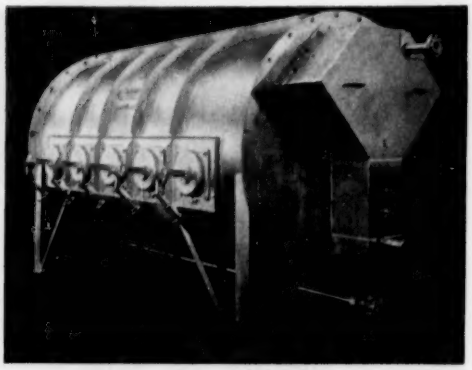


Gradiation barrel heater superheats steam in two precisely-controlled stages of continuous coking process at Tidewater Oil Co.'s new Delaware refinery.



Above: Three low-capacity Gradiation heaters . . . ½-million, 1-million, 2-million Btu/hr . . . in reboiler service at a Louisiana refinery.

Below: 2-million Btu/hr Gradiation unit provides uniform heating and good thermal efficiency for asphalt service.



. . . because Selas builds more heat into fewer cubic feet!

It's important for you to know this: Low-capacity Gradiation Heaters deliver heat uniformity at lowest possible structural cost!

In the chemical, petrochemical and petroleum industries . . . where heat capacities under 10 million Btu per hour are desired . . . the advantages of Selas Gradiation may now be enjoyed *at low first cost.*

Selas Gradiation uses a multiplicity of Duradiant® burners which may be placed only 2 feet from the tubes. This makes possible smaller, more compact heaters, with consequent savings in structural costs.

On the other hand, conventional heaters use relatively high capacity flame-type burners which require greater heater volume to avoid flame impingement on the tubes.

In addition to low first cost resulting from structural savings, you get these advantages with Selas Gradiation:

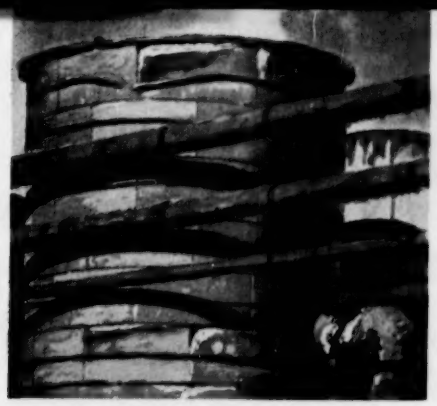
- Duradiant burners permit *instant response to controller demand*
- Uniformity of heat application with no flame impingement and complete combustion with no excess air *combine to eliminate "tube metal" degradation*

For low-capacity heating with low first cost you should choose Selas Gradiation.

For complete information write for Bulletin 1010 "Gradiation Heating for Petroleum and Chemical Processing."

SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers
DEVELOPMENT • DESIGN • CONSTRUCTION



Acids and acid industrial atmospheres will ruin some insulations...



FOAMGLAS®

INSULATION

is acid-proof!

—like any true glass, FOAMGLAS is not attacked by common acids and acid fumes. And inorganic FOAMGLAS is the only thermal insulation which combines all these additional performance benefits in one material: it is waterproof and vapor-proof . . . incombustible . . . has remarkable compressive strength . . . is easy, economical to handle and install. Write today for detailed literature.

Pittsburgh Corning Corporation

Dept. H-107, One Gateway Center, Pittsburgh 22, Pa.

In Canada: 57 Bloor Street West, Toronto, Ontario

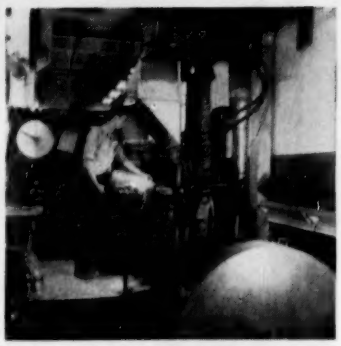
DUST and FUME topics

WHEELABRATOR CORPORATION Mishawaka, Indiana

WHEELABRATOR® COLLECTORS TURN PROBLEMS INTO PROFIT

Save $10,000 Yearly Ventilating Banbury Mixers at Lord Mfg. Co.

Lord Mfg. Co. of Erie, Pa., operates 2 Banbury mixers to mix carbon black, sulphur and other materials with rubber stocks. Ventilation of each mixer by a Wheelabrator Dustube Collector keeps carbon black and other material from escaping into the air. Because this material is collected in the dry state, it can be returned to the batch. Besides the product savings of $10,000 yearly, the return of the material also insures proper mixture throughout the batch cycle to maintain quality. Better working conditions are also provided.



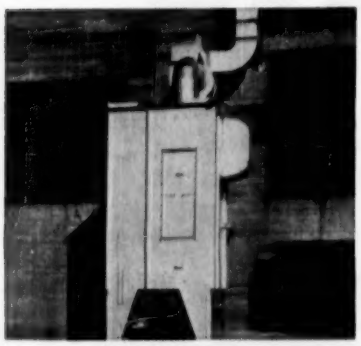
'Super-Clean' Air at Low Cost

- *New dust control principle is efficient, economical*
- *"Ultra filtration" gives service 24 hours a day*
- *"Ultra filtration" ends instrument repair*

"ULTRA FILTRATION" with Wheelabrator Dustube Collectors uses an inexpensive filter aid to collect fine atmospheric dust at low cost and with unusually high efficiency.

★ ★ ★

THERE IS CONSTANT demand for super-clean air in the hammer mill room at Columbia-Geneva Steel



Div. of U.S. Steel Corp. Two 500 H.P. synchronous motors operate 168 hours a week. Wheelabrator "Ultra Filtration" has provided clean air with virtually no maintenance costs in the first year.

★ ★ ★

INSTRUMENTS in the sinter plant control room which is in a very



dusty location at Columbia-Geneva required regular costly repairs until Wheelabrator "Ultra Filtration" was installed. Dust has ceased to be a problem in operation and maintenance of recording and control instruments since installation of Wheelabrator "Ultra Filtration."

★ ★ ★

"ULTRA FILTRATION" is ideal for electrical control rooms, laboratories, manufacturing areas, etc. Write today for complete details.

SAVINGS PAY EQUIPMENT COSTS at CHEMICAL CO.

Installed to regulate dust that was a nuisance to Cotton States Chemical Co. and its neighbors in Monroe, La., three Dustube Collectors are paying for themselves in values collected and returned to the products. More than $100 worth of Benzene Hexachloride, DDT, Toxaphene and Aldrin is saved daily.



SEND FOR THIS CATALOG

For more complete details on Dustube savings in the chemical industry, write today for Catalog 372C.



WHEELABRATOR

CORPORATION

347 South Byrkit St., Mishawaka, Ind.

INTERNATIONAL
MAGNESIUM OXIDE 99.0+%

In the highest purity ever produced in carload quantities and in the low price range



International MgO has demonstrated its versatility and superiority in these and many other applications—

- **AS A STABILIZING AND VULCANIZING AGENT FOR RUBBER**
- **IN HIGH TEMPERATURE HEATING ELEMENTS**
- **AS A PRECIPITANT OF YELLOW CAKE IN URANIUM ORE TREATMENT MILLS**
- **IN PRODUCTION OF HIGH-MELTING-POINT REFRACTORY BRICKS**

International's research staff is prepared to give you technical assistance in the study of end use problems. Please use the coupon in requesting samples and more information.

chemical specifications

chemical		purity range
MAGNESIUM OXIDE	MgO	99.00 – 99.80%
IRON	Fe_2O_3	0.04 – 0.06
LIME	CaO	0.07 – 0.08
SILICA	SiO_2	0.05 – 0.10
ALUMINA	Al_2O_3	0.04 – 0.09
BORON	B_2O_3	0.003 – 0.01
CHLORIDE	Cl	0.02 – 0.04
SULFATE	SO_4	0.03 – 0.05
SODIUM AND POTASSIUM	$Na+K$	0.02 – 0.04
LOSS ON IGNITION		0.20 – 0.30

physical specifications

(Color . . . White)

PELLETS
Approx. 1/8" x 3/8", plus 12 mesh
Bulk density: 60 lb. cu. ft.

GRANULAR
All minus 12 mesh
Bulk density: 70 lb. cu. ft.

POWDERED
100% minus 200 mesh
90%+ minus 325 mesh
Bulk density: 80 lb. cu. ft.

shipments

Bulk in box cars and covered hopper bottom cars, minimum 30 tons net.

80 lb. net multi-ply paper bags with moisture resistant barriers and 100 lb. net fiber drums for carload, truckload and L.C.L. deliveries.

All shipments F.O.B. Carlsbad, New Mexico.

Direct truck service to all points in the Colorado plateau on 24 hours' notice.

price range

International MgO prices range from $110 to $250 per ton, F.O.B. Carlsbad, depending on grade, packaging and quantity.

INTERNATIONAL MINERALS *International* MINERALS CHEMICALS **& CHEMICAL CORPORATION**

POTASH DIVISION .... 20 N. Wacker Drive, Chicago 6

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LOOK TO
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Caustic Potash	Sulfate of Potash
Carbonate of Potash	Potassium Chloride
Liquid Chlorine	Muriatic Acid
Hydrofluosilicic Acid	

INTERNATIONAL MINERALS & CHEMICAL CORPORATION
20 North Wacker Drive, Chicago 6

☐ Please send me samples of MgO in ..... form
(pellet – granular – powdered)

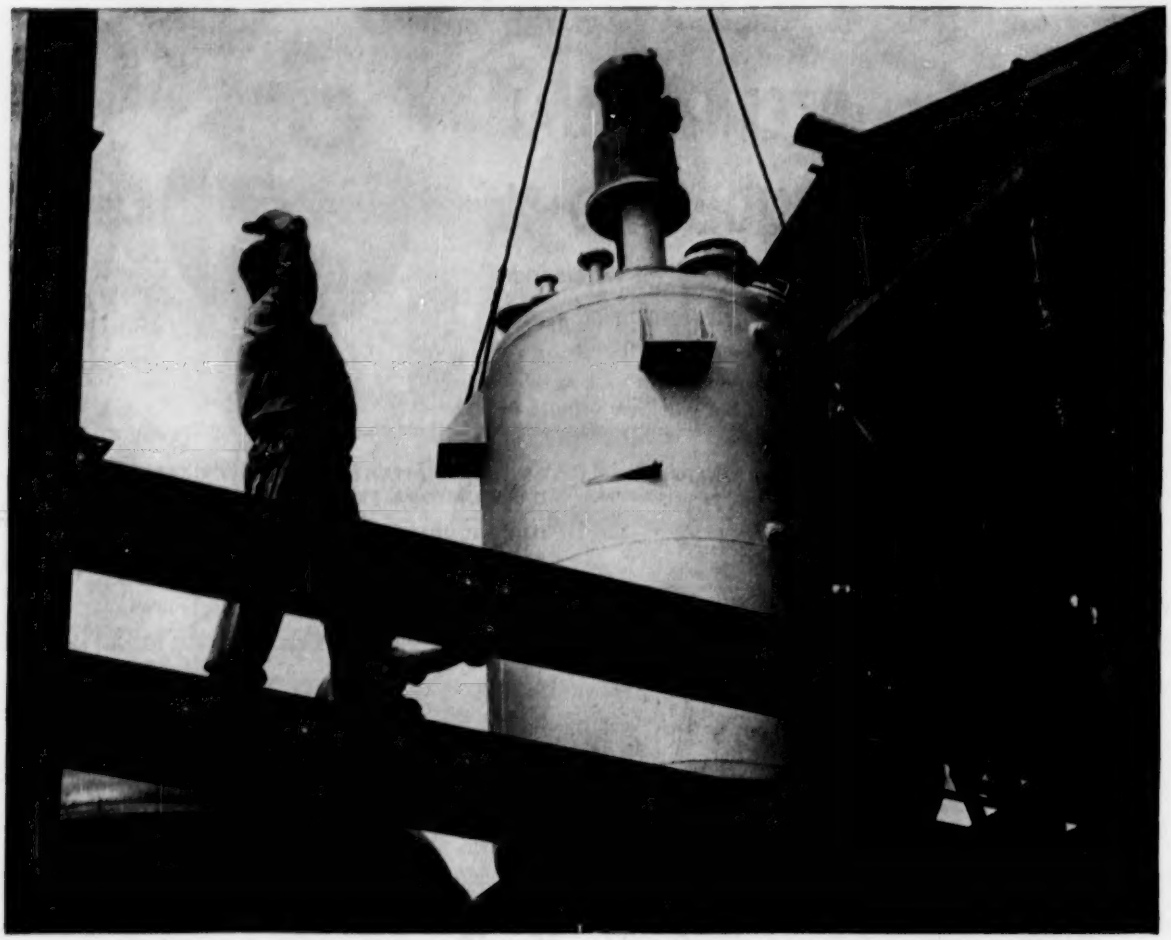
☐ Please send Magnesium Oxide Brochure
My field of interest for MgO is .....

Name .....

Firm .....

Address .....

City ..... State .....



No HF corrosion with new Monel-clad vessel

Past savings prompt Catalin Corporation to add another Lukens clad steel alkylation reactor

Resistance to small amounts of hydrogen fluoride resulting from the hydrolysis of boron trifluoride catalyst —at 250 deg. F. and 50 psi—is a major design requirement for Catalin Corporation's alkylation reactors.

Catalin met the requirement and kept original costs down in reactors such as this with Lukens 5/8" 20% Monel-clad steel. Monel cladding adequately resists the hydrogen fluoride. The low-cost A-285 backing steel provides the initial economy over solid high alloy. Because the kettle is jacketed, heat transfer is enhanced by the clad steel. The material also resists abrasion. Long life is assured.



Alkylating kettle of Lukens 5/8" 20% Monel-clad steel promises corrosion protection, economy at Catalin Corp.'s Fords, N. J. plant.

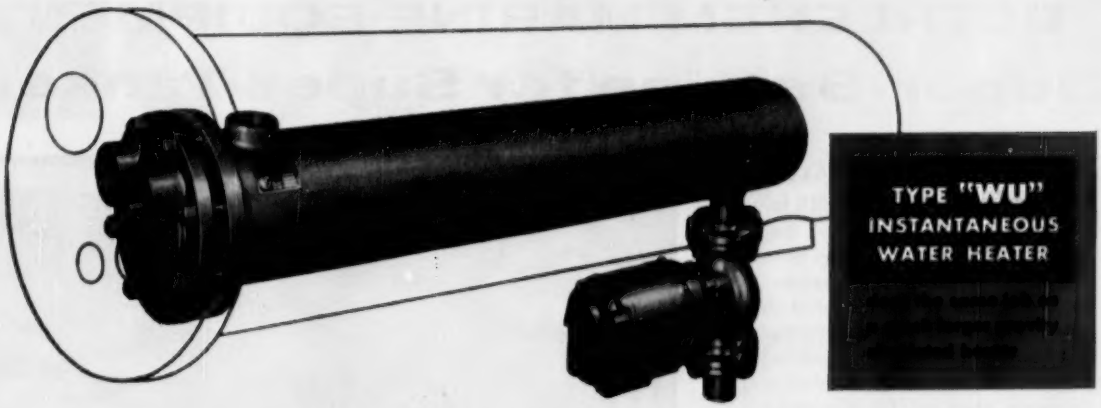
It's another example of how Lukens clad steels, from 3/16" gage up, are improving efficiency and saving money in the chemical industry. Only Lukens gives you a choice of 19 cladding and 11 backing metals—to meet virtually any tank or pressure vessel need. *Consult your equipment builders or write for new technical booklet, "Clad Steel Equipment." Address Manager, Marketing Service, Room 971, Lukens Steel Company, Coatesville, Pa.*



This is Lukens clad steel—not a lining, not a soldered-on surface, but a solid steel plate—one side corrosion resistant metal permanently bonded over-all to a rugged, economical backing steel.

LUKENS

Helping industry choose steels that fit the job



PRODUCES *MORE HOT WATER*...SAVES SPACE...SAVES MONEY

Pumped boiler water circulation steps-up capacity...permits close temperature control

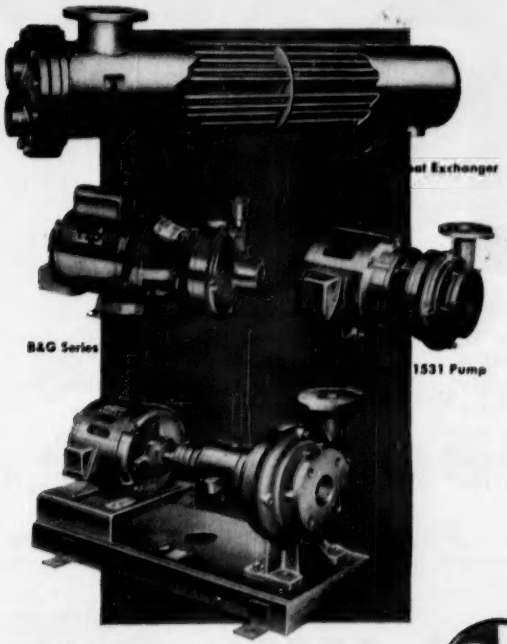
This B&G Heat Exchanger offers three important advantages—

1. More hot water from a smaller unit. The "WU" comes equipped with a B&G Booster Pump which pumps boiler water through the baffled shell, greatly increasing the capacity of the heater. Large volumes of hot water are produced by amazingly small units.

2. Controls water temperature. The Booster is controlled to start whenever water temperature goes below the desired degree. Boiler water is pumped through the shell of the "WU" until service water is again at the correct temperature.

3. Cuts installing cost. Because of pumped circulation, the smaller piping and fittings required materially reduce cost...cutting and threading can be done on the job. No storage tank needed.

"WU" Heat Exchangers can be installed on hot water boilers or below the water line of steam boilers.



B&G Series 1510 Type B Pump

*Do you receive our Monthly Availability Report on B&G Heat Exchangers? If not, send your name.

FAST DELIVERY

ON PUMPS AND HEAT EXCHANGERS FROM FACTORY STOCK ON HAND*

A comprehensive stock of most commonly used sizes of heat exchangers and pumps is maintained at the factory —ready for immediate delivery. Your local distributor or B&G Representative will be glad to assist in selecting the proper unit for your needs. Or, write, phone or wire the Bell & Gossett factory at Morton Grove, Illinois.

B&G Heat Exchangers are products of over a quarter century's experience in heat exchange design...manufactured under constant supervision to ASME Code. B&G stock Centrifugal Pumps are distinguished by vertical split-case design...bronze-fitted construction...non-overloading motors and leak-proof "Remite" mechanical seals. They can be serviced without disconnecting pipe lines or motor leads.



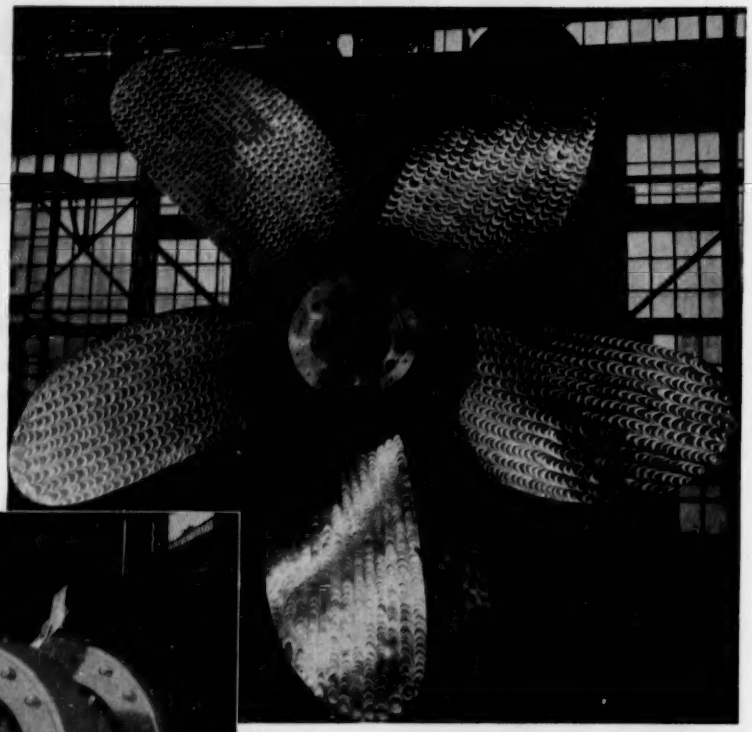
Send for catalogs of B&G Heat Exchangers and Centrifugal Pumps.

BELL & GOSSETT
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Dept. EZ-14, Morton Grove, Illinois
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BETHLEHEM MARINE EQUIPMENT
Super-Service for Super-Tankers

BETHLEHEM'S NICKEL-ALUMINUM BRONZE PROPELLERS have a life span up to *6 to 8 times longer* than comparable manganese bronze wheels. They are approximately *18 per cent lighter* in weight, and provide *greater propulsion efficiency* and fuel savings. Unusually rugged, with extreme resistance to erosion and corrosion, they *pay for themselves* in Super-Service.

The Nickel-Aluminum Bronze Propeller shown here was designed, cast and finished-machined by Bethlehem for a 46,000-dwt tanker. It has a diameter of 22½ ft and finished weight of 67,200 lb.





▲ **BETHLEHEM'S UNIVERSAL CHOCK** protects expensive mooring lines from chafing or fraying during warping, mooring or towing operations. Ruggedly constructed of cast steel, it takes heavy radial loads through a rotating center member completely supported and accurately aligned on ball bearings. This center can turn 360° and keeps the mooring line in full contact with the rollers of the chock's riding sheave. Designed and constructed for *maximum service and minimum maintenance*, it's a boon to the cost-conscious ship operator.

**In Europe, Asia, Africa and Australasia, BETHLEHEM'S UNIVERSAL CHOCK is handled by Friedrich Kocks GMBH of Bremen, Germany, under an exclusive sales and manufacturing agreement.*

PROPELLERS

Nickel-Aluminum Bronze,
Nickel-Manganese Bronze, Manganese Bronze,
Iron and Steel.

SPECIAL PRODUCTS

Geared Turbine Propelling Machinery.
Turbine Rotors, Blading and Accessories.
Line, Propeller and Crank Shafts.
Condensers. Feed Heaters.
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Special Valves and Fittings.
Bronze, Iron and Steel Castings.
Rudders. Stern Frames. Stern Tubes and Bushings.
Fabricated Steel and Weldments for Floating Units.
Machine Work.

Single and Multiple Effect Distilling Plants

NAVAL ARCHITECTS
MARINE and NUCLEAR ENGINEERS

Unusual opportunities in many engineering categories are now available. Here's a once-in-a-lifetime chance to join the world's foremost shipbuilding organization. Address Dept. 272.

BETHLEHEM STEEL
Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation



more motor
than ever before



1 TO 50 H.P.

THE REVOLUTIONARY TYPE H

U. S. UNICLOSED

more motor dependability is the result of more and more exclusive features: Asbestos insulation against heat and moisture; Lubriflush bearing construction for longer life; Ventrifoil baffles to direct air, deflect moisture; rugged, normalized cast iron frame . . . all Uniclosed Type H features for longer motor life, more efficient power. Write for profusely illustrated multicolor bulletin today.

U.S. Electrical MOTORS

more LIFE

Lubriflush replaces old grease with new, for longer bearing life. Other life-lengthening features of Uniclosed are explained below.



more RUGGED

Cast-iron frame defies distortion. The smooth cast-iron surface is highly corrosion-resistant. Heavy solid feet are a substantial part of the frame.



more PROTECTION

Ventrifoil directs air, deflects water. Each end of motor has specially formed deflector that directs air around bearing housings, into fans on rotor.



more INSULATION

U. S. multiple protection increases insulation life. ASBESTOS — for protection against heat. POLYESTER FILM—for greater physical strength.



more CONVENIENT

The spacious conduit box on Uniclosed Type H is heavy-duty cast-iron, diagonally split type, attractively contoured —easy of access.



MAIL COUPON NOW

U. S. ELECTRICAL MOTORS INC. CE-9
P. O. Box 2058, Los Angeles 54 or Milford, Conn.

☐ *Send Uniclosed Type H Bulletin No. F-1856*

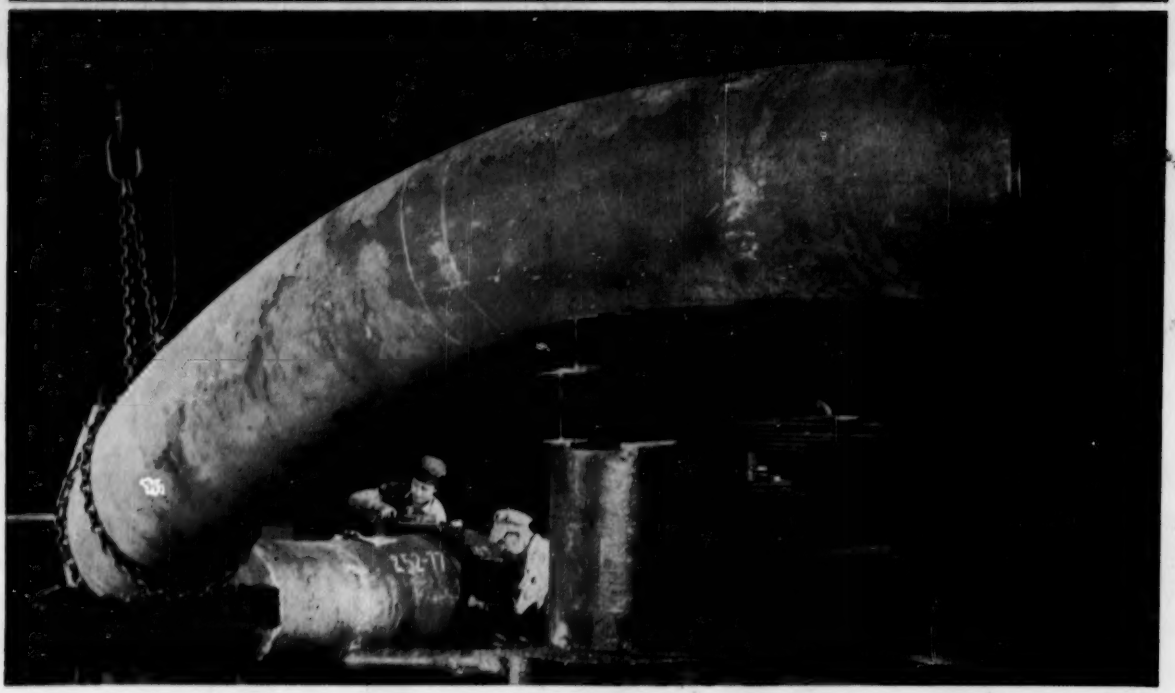
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COMPANY _____

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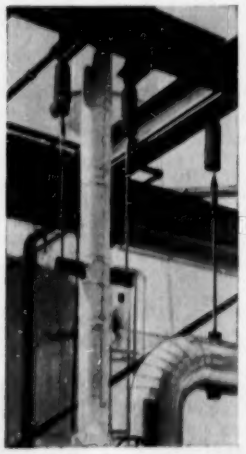
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BLAW-KNOX has what it takes—to provide these products and services



Large chrome moly pipe being readied for shipment to new generating station. Making a right angle bend followed by a 24 degree, 18 foot bend in this heavy 27½ inch chrome moly pipe required all the skill and modern facilities of the Blaw-Knox power piping shop. Before shipment, piping is heat-treated and ultrasonically tested with a radar-type device for detection of any defects.

A new Blaw-Knox "6 x 6" Flexibility Matrix Method of computing stresses in power piping systems is now available to consulting engineers, companies, and individuals responsible for the design of power piping systems. By the use of an electronic computer this method cuts calculating time from months to a day; assures full accuracy to six significant figures; and has no limitations on the complexity of the system. Write for further information about our new "6 x 6" Flexibility Matrix Method.



Two-way control over movement of piping is provided by Blaw-Knox functional spring hangers with the patented internal swivel action—shown in this modern outdoor generating station. Our experienced engineers are available to both design and make recommendations for your hanger requirements. To get full information, write for Catalog No. 54.

Each year serious fire strikes one out of every seven manufacturing firms in this country. Be safe. Let a Blaw-Knox fire-protection engineer study your needs—and explain how you can pay for the system on our lease or deferred payment plan. To get more information send for Bulletin No. 2426—"Fire Can Destroy Your Business."



BLAW-KNOX COMPANY

Power Piping and Sprinkler Division

829 Beaver Avenue • Pittsburgh 33, Pennsylvania

Complete facilities for prefabrication and erection of piping systems for all pressures and temperatures . . . complete line of standard and custom-engineered pipe hangers, supports and vibration eliminators . . . complete line of automatic sprinkler systems for standard and special hazards



BIG EVEN FOR TEXAS

Four giant towers of the Phillips Petroleum Company's Natural Gas Liquids Fractionating Unit #10A rise over the Texas prairie. It is one of the largest units of its kind in the world.

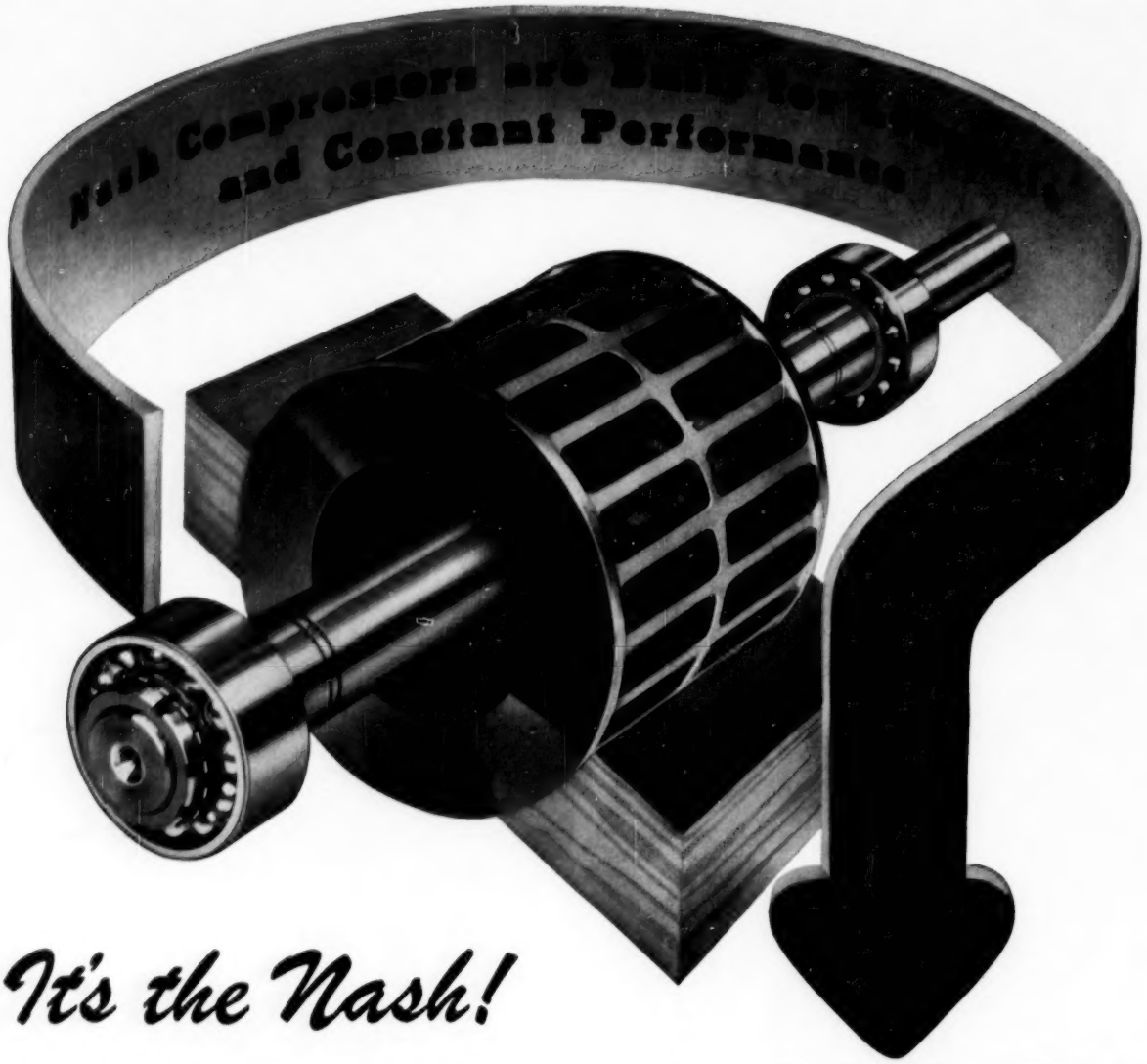
A unique infra-red and differential refractometer analysis system developed by Phillips provides continuous product and quality control. Stone & Webster Engineering Corporation performed the detailed engineering, design and construction of this unit utilizing process information supplied by Phillips.

Stone & Webster designs and builds all types of installations, both large and small, for process industries all over the world. Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York • Boston • Chicago • Pittsburgh • Houston • San Francisco • Los Angeles • Seattle • Toronto



It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature Automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

312 WILSON, SO. NORWALK, CONN.

Manufacturer Improves Performance of Chemical Mixer with Armco 17-4 PH Stainless Steel



Special Armco precipitation-hardening stainless assures corrosion resistance, greater hardness, less distortion

The screw of this continuous chemical mixer requires a combination of high hardness, accurate dimensions and corrosion resistance. It was formerly made of a standard hardenable grade of stainless steel. By switching to Armco 17-4 PH, the manufacturer obtained increased hardness, longer wear, better corrosion resistance and less distortion in hardening the part.

Wide Application for 17-4 PH

This new Armco Stainless Steel is being used to improve the performance and simplify the production of many parts of chemical processing equipment because it offers a *combination* of properties never before available.

- **High hardness and tensile strength**
- **Excellent resistance to galling and wear**
- **Good corrosion resistance, comparable to Type 302**
- **High mechanical properties up to 900 F**
- **No scaling, minimum distortion because of low temperature heat treatment**

Designers are specifying Armco 17-4 PH for parts such as valve sleeves, stems, plugs and discs; pump shafts, gears and plungers; studs, bolting and reinforcing bars for high pressure equipment and similar applications.

Where your equipment calls for stainless steel with high mechanical properties, consider the performance and production advantages you can gain with Armco 17-4 PH. It is available in bar, wire and billets. Armco 17-7 PH, a companion grade with similar properties is produced in the form of strip, sheet, plate, bar and wire.

Full information on both grades is contained in a new Armco catalog. Just fill in and mail the coupon for your free copy.

ARMCO STEEL CORPORATION
2047 Curtis Street, Middletown, Ohio

Send me a copy of your catalog, "Armco Precipitation-Hardening Stainless Steels."

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Company_____

Street_____

City_____ Zone_____ State_____

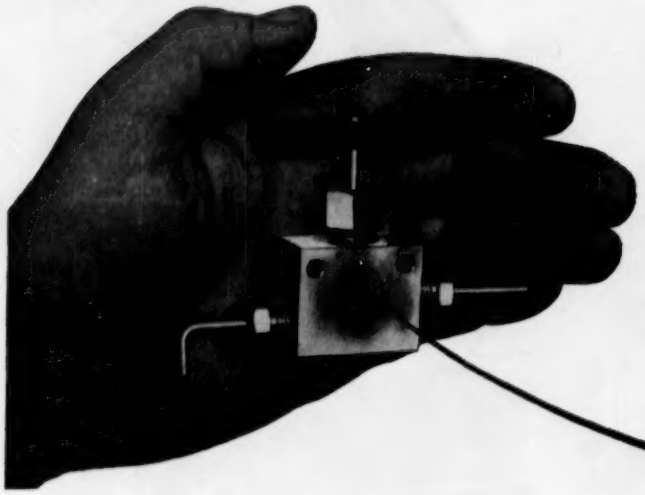
ARMCO STEEL CORPORATION

2047 Curtis Street, Middletown, Ohio

Sheffield Steel Division • Armco Drainage & Metal Products, Inc. • The Armco International Corporation

On Your Instrumentation—Sampling—Bench Scale "Set-ups"

THIS 15,000 psi VALVE FOR ⅛" O.D. TUBING SAVES TIME...SAVES SPACE...SAVES MONEY

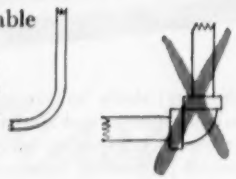


- *Made of 304 s.s.*
- *It's Safety-locked... Small... Easy To Install*
- *Eliminates Threading, Swaging, Flaring, Welding*

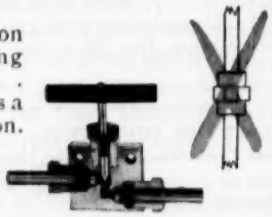
POSITIVE SAFETY LOCKING DEVICE prevents inadvertent loosening of gland nut at any time. Safety locking pin must be removed deliberately before gland nut can be loosened.

ELIMINATE COSTLY PIPING WITH TUBING and ▲ TUBING VALVES

With Tubing (available from stock)... Every bend saves a fitting and two threading operations.



With ▲ Tubing Valves... Every connection saves threading and welding... and every joint is a union connection.



Here's how you can speed up and simplify valve and fitting installations in your instrumentation, sampling, process lines and numerous other bench-scale "set-ups": USE TUBING and ▲ TUBING VALVES. The ▲ ⅛" O.D. Tubing Valve shown here, for example, is installed in three easy steps:

1—Cut tubing to desired length, deburr
2—Slip adapter nut and sleeve onto tubing
3—Insert tubing into valve and tighten adapter nut.

That's all there is to it. No threads to cut... no beveling... no swaging, flaring, welding. In a matter of seconds, you've got a gas-tight seal for pressures up to 15,000 psi. And every joint is a union connection.

Get the complete story about this valve. SEND FOR BULLETIN 857.

Autoclave Engineers
2932 WEST 22nd STREET • ERIE, PENNSYLVANIA

LIMBERING UP LUMBER-HANDLING WITH

CYPAK

by putting memory into the carriage conveyor system at Lutcher & Moore's Orange, Texas Mill

CYPAK* static controls—outliving conventional relays 15 times over—are now being used at Lutcher & Moore's Orange, Texas Mill to control resaw conveyors on the lumber industry's first aluminum log carriage.

By putting memory into the carriage conveyor system, CYPAK automatically and unerringly separates waste from good boards, diverts slabs to the chipper, automatically sorts and grades, and returns boards requiring another cut back to the saw. Result: a faster, more efficient operation . . . substantial savings in materials handling . . . greater utilization of raw materials.

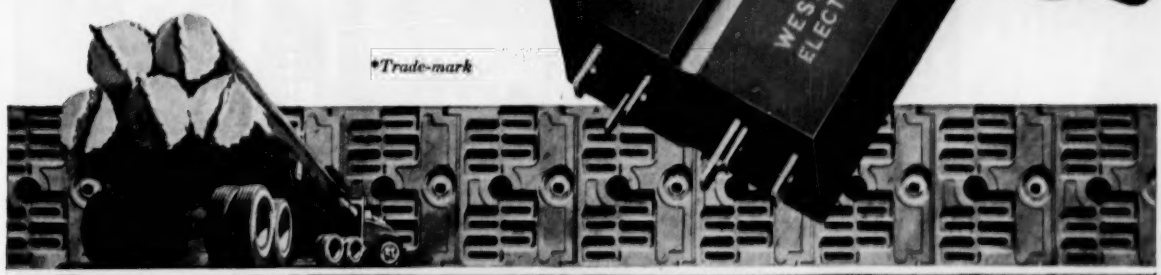
For complete information about the ways CYPAK can benefit you, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-22063

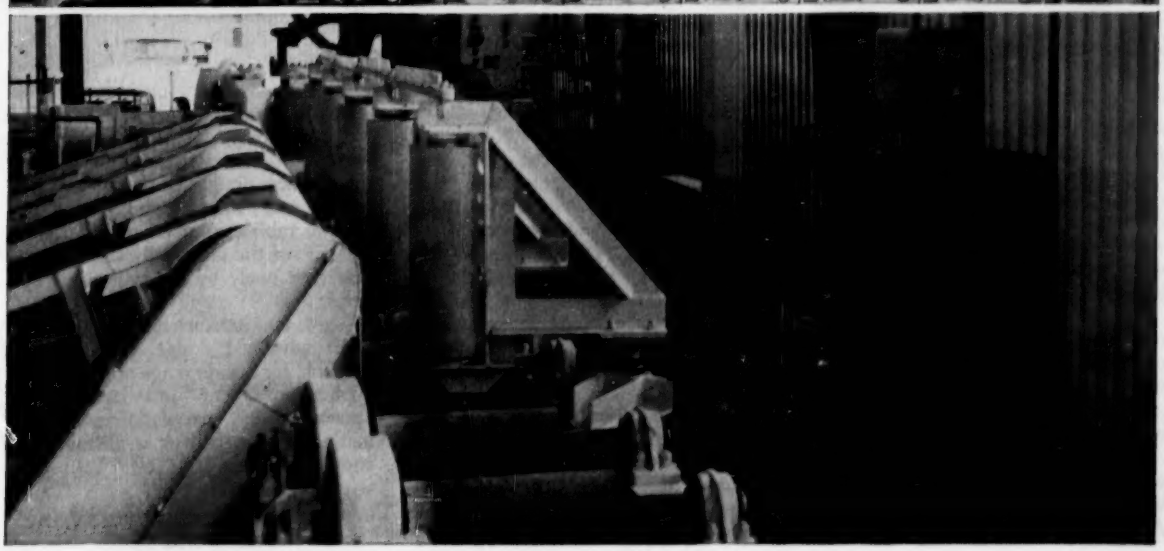
YOU CAN BE SURE...IF IT'S

Westinghouse



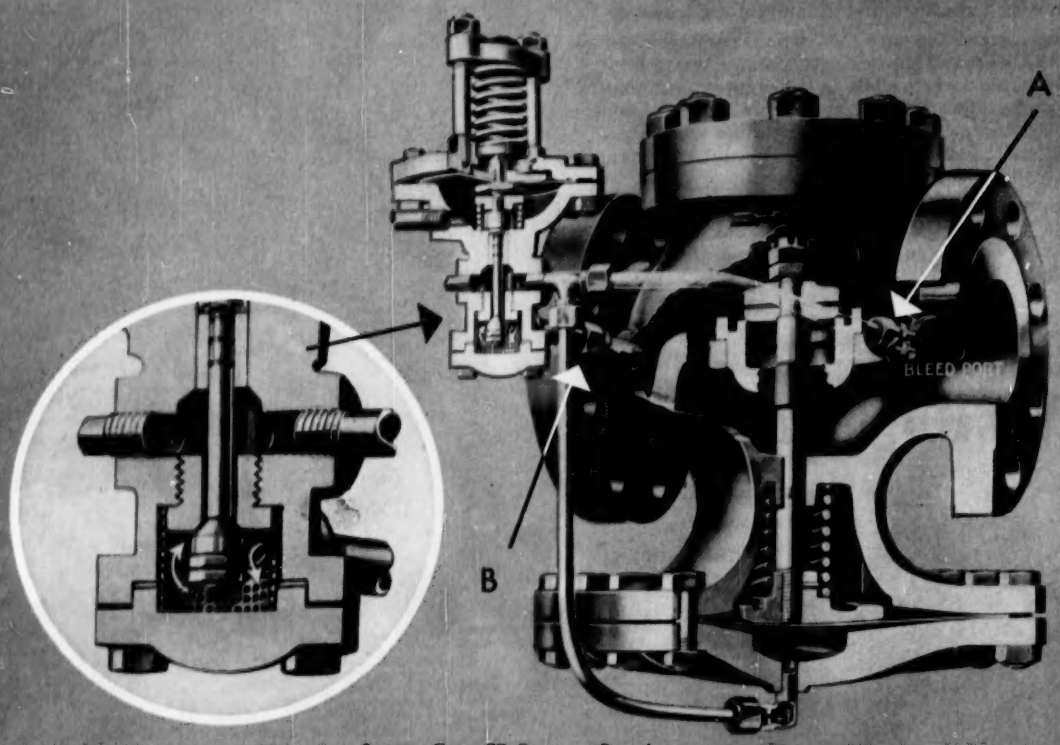
*Trade-mark





VALVE TIPS:

Advantages of External Pilots in Automatic Regulating Valves



Spence Type ED Pressure Regulator

"Maintenance-free, trouble-free, install-and-forget." They're all pretty phrases, but every engineer knows from experience they don't apply to regulating valves. Any valve designed to control temperatures or pressures within tight limits can be affected by dirt or other foreign matter in steam lines.

One advantage of the external pilot mounting shown above is simplified maintenance. Trouble shooting is faster, downtime is reduced, and tempers don't take such a beating. Here's why:

If trouble develops, it's easy to find out if it's in the pilot or the main valve. Just remove the tubing bend at A. A simple test, without any instruments or other equipment, shows where the trouble is.

If the trouble is in the pilot, you can remove it by disconnecting the unions at B. There's no need to take the main valve out of the line.

The quickest way to get the regulator functioning again is to install a spare pilot. This is easy — and in the Spence design it's not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves. There's no need to stock an expensive inventory of pilots for each main valve size.

In the enlarged sectional drawing above, you can see how the strainer, seat and disc of the pilot are readily accessible by removing the blind flange.

If the trouble is in the main valve, here again inspection is easy. If there's dirt in the steam line, it may clog the bleed port or restriction orifices. In the Spence design these can be inspected and cleaned by merely removing the tubing connections. The seat and disc of the main valve can also be inspected easily by removing the top flange.

These maintenance advantages, plus other advanced design features, are available for a wide range of regulating applications. For information on Spence's wide range of different automatic regulating valves, write for your copy of Bulletin 1005.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York



World's Finest Tranquilizer

For a Chemical Engineer Worried About Materials

Whether industrial chemicals are in long or short supply, this is *still* the best way to reduce your purchasing and production worries: *Buy where you get the greatest assurance of quality materials and dependable service!*

That's why you find more and more industrial chemical users turning to Pittsburgh Coke & Chemical for their coal-derived materials. As a basic producer of phthalic anhydride, plasticizers and other quality-controlled coal chemicals, Pittsburgh offers you these practical and positive advantages:

1. Elimination of production problems due to variations in quality of materials.
2. Fewer quality-control checks required in your plant.
3. Better products, greater acceptance by the trade and consumers.
4. Less customer complaints, fewer expensive adjustments, fewer service calls.

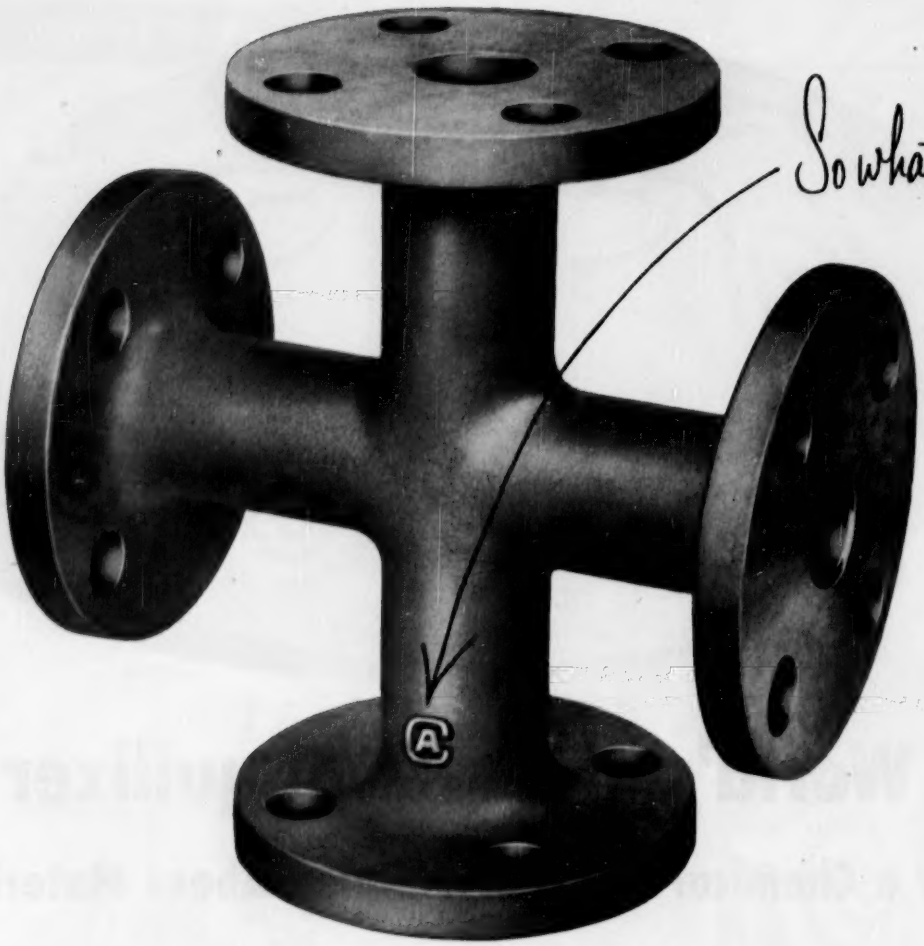
And to all of those benefits you can add Pittsburgh's respect for your delivery schedules, plus a technical service department that is alert and competent. *Write today for more information on the Pittsburgh Chemicals listed below.*

Pittsburgh Industrial Chemicals

Phthalic Anhydride, Maleic Anhydride, Fumaric Acid, Plasticizers, Benzene, Toluene, Xylene, Pyridine, Alpha Picoline, Beta Gamma Picoline, Phenol, Ortho Cresol, Meta Para Cresol, Xylenol, Sulphuric Acid, Oleum, Ammonium Sulphate, Phthalocyanines, Fungicides.



COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON



There's a good reason for the CA trademark on our STAINLESS STEEL FITTINGS

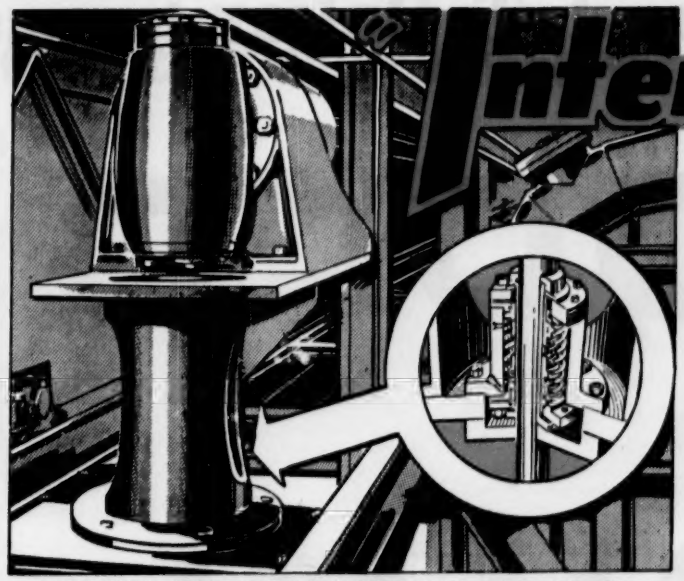
Behind the Cooper Alloy trademark stands more than *a quarter century of experience* in the manufacture of stainless steel fittings...and every year of this experience is reflected in completeness of line, soundness of design, quality of workmanship and availability of the product.

Regularly stocked in types 304, 316, 347 and FA20, and available on short delivery in the extra low carbon (ELC) grades as well as in nickel or monel, the Cooper Alloy line is sold and serviced by industrial distributors, mill supply houses and piping distributors with branches and warehouses in key cities. Backed up by a network of regional representatives, sales engineers and the most intensive continuing research program in the industry, these distributors offer maximum service and fast delivery.

Every step in production, from the original design through the patternmaking, coremaking, molding, melting, heat treatment, pickling, machining, testing and shipping is under the direct control of Cooper Alloy stainless steel specialists. Look for the CA trademark before you buy . . . It's a sign of quality, experience and reliability.

Catalog 55F available on request.

COOPER ALLOY CORPORATION
Valve and Fitting Division • HILLSIDE, N. J.



International's

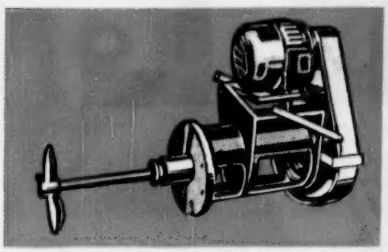
First in CHEMICAL MIXING AND PROCESSING

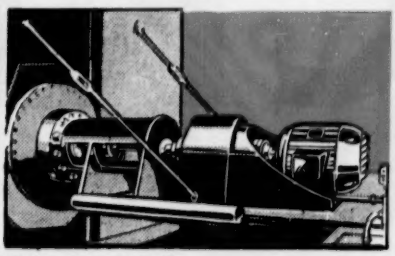
Whether you're expanding your present facilities, or building a new plant be sure to check with INTERNATIONAL for the latest engineering developments in the correct and most economical MIXING, BLENDING, TREATING AND GRINDING of Chemical Components.

...Ask for Special Bulletins on any product —no obligation, of course.

"LFR" SLOW SPEED TURBINE TYPE MIXER — 1 to 100 H.P.

Low Head Room—Speed Ranges 1 to 350 R.P.M.—Mechanical Efficiency 96 to 98½%—AGMA ratings—All steel gear housing—Equipped with Mechanical Seal or Standard Packed Stuffing Box—for open or closed tank operation.





SIDE ENTERING MIXERS—½ to 30 H.P.

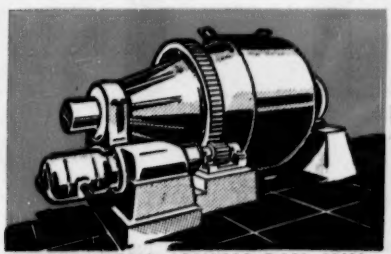
INTERNATIONAL can furnish either standard packed Stuffing Box or Mechanical Seals—On most standard types of Side Entering Mixers either Seal can readily be converted to the other, as desired.

SHUT-OFF CONNECTION on Side Entering Mixers allows repacking or replacement with either Standard Stuffing Box or Mechanical Seals with a full head of liquid, without appreciable leakage.



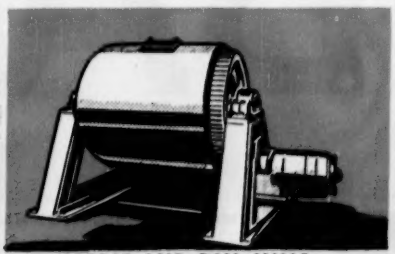
CONICAL DRY BLENDERS

Specially Engineered and adapted to your Product, INTERNATIONAL Conical Dry Blenders are the standard of Lower Blending Costs for Hundreds of Chemical Products. Standard sizes ranging in capacity from 25 to 10,000 lbs. for densities of from 20 to 100 lbs. per cu. ft.



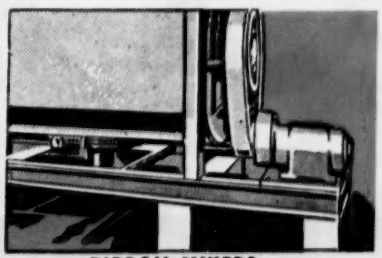
CONTINUOUS CONICAL BALL MILL

For Wet and Dry Grinding. Adapted to open or closed circuit operations. Welded Steel Construction, with high production and mechanical efficiency. Furnished in all standard sizes and capacities from 36" x 8" to 120" x 48" inclusive.



PEBBLE AND BALL MILLS

Of Welded Steel Construction, and furnished in all Standard Sizes from 18" x 24" to 96" x 144" inclusive, with 9 different drive arrangements. Equipped with Anti-Friction, Self-aligning Roller Bearings, reducing h.p. requirements by as much as 25%.



RIBBON MIXERS

INTERNATIONAL Ribbon Mixers are so designed that any desired proportion of various materials can be thoroughly mixed. Simplified Agitator Construction allows quick removal and easy cleaning. 16 Standard Sizes from ¼ to 175 cu. ft. capacity.

Technical Bulletins Available

Top Entering Agitators	73, 76, 76-A, 81
Side Entering Agitators	72-B
Portable Mixers	74-A
Mixing & Extruding Machinery	62-A
Dry Blenders & Ribbon Mixers	78
Grinding & Melting Pans	5
Ball & Pebble Mills	100-A, 190-B
Laboratory & Pilot Plant Equipment	77-A
Stock Pans & Dust Boosters	109-A

For the best in mixing and processing—consult

INTERNATIONAL Engineering, Inc.

NEW YORK
15 Park Row
WO-rth 2-2580

DAYTON 1, OHIO

How many of these J. T. Baker tonnage

COPPER

NICKEL

COBALT



ALL THE COPPER, NICKEL AND COBALT COMPOUNDS listed above are manufactured by Baker in tonnage quantities to exacting standards. They are *economical to buy* and *economical to use.*

Note particularly the low limits of important impurities as defined by specifications or indicated by typical analyses. Why not put Baker *Purity by the Ton* to work in your plant? You may find you can simplify your process by eliminating one or more purification steps—by reducing the number of variables—or by saving valuable testing time.

In relation to grade you can count on *low initial cost—controlled purity*—and *economy-of-use.* You can specify these Baker tonnage chemicals with confidence for a wide range of large scale industrial applications. May we quote on your requirements?

PURITY BY THE TON

chemicals do you need for production use?

Cupric Acetate Reagent
Cupric Carbonate Reagent
Cupric Chloride Reagent and Purified
Cupric Nitrate Reagent, Purified, Tech.
Cupric Oxide Reagent Pdr. and Reagent Wire
Cupric Sulfate Reagent, Fine Crystal
Cupric Sulfate Reagent, Anhydrous Powder
Cuprous Chloride Reagent Powder

USES

- Ingredients of catalyst mixtures
- Ingredients of mineral supplements
- Textile mordants
- Photographic fixers
- De-nitrating agents
- Ingredients of fungicides and insecticides
- Coloring agents for glass and ceramics
- Process materials in metallurgical operations

Analytical Determinations	Cupric Chloride: Reagent Crystal Specif. Limit	Cupric Chloride: Purified Crystal Typical Analysis	Cupric Nitrate: Reagent Crystal Specif. Limit	Cupric Nitrate: Purified Crystal Typical Analysis	Cupric Nitrate: Technical Crystal Typical Analysis	Cupric Oxide: Reagent Powder Specif. Limit	Cupric Oxide: Reagent Wire Specif. Limit	Cupric Sulfate: Reagent Fine Crystal Specif. Limit
Typical Copper Content (as Cu)	37.1 %	36.9 %	26.7 %	26.9 %	26.2 %	78.7 %	–	25.4 %
Water Insolubles	0.010%	0.01%	0.010%	0.02%	0.14%	–	–	0.005%
Acid Insolubles	–	–	–	–	–	0.030%	–	–
pH of 5% Solution	–	–	3.0-4.5	–	–	–	–	–
Carbon compounds (as C)	–	–	–	–	–	0.010%	0.001%	–
Chloride (Cl)	–	–	0.002%	–	–	0.005%	–	0.001%
Nitrogen compounds (as N)	–	–	–	–	–	0.002%	0.001%	0.001%
Nitrate (NO_3)	0.005%	–	–	–	–	–	–	–
Subst. not ppt. by H_2S (as SO_4)	0.10 %	0.15%	0.050%	0.07%	0.15%	0.20 %	–	0.10 %
Iron (Fe)	0.005%	–	0.005%	–	–	–	–	0.003%
$(NH_4)_2S$ Metals other than Fe (as Pb)	–	–	0.005%	0.03%	–	–	–	0.005%
Lead (Pb)	–	–	0.001%	–	–	–	–	–
Sulfate (SO_4)	0.005%	–	0.005%	–	–	–	–	–
Buffer Compounds (as SO_4)	–	–	–	–	–	0.030%	0.004%	–
Free Alkali	–	–	–	–	–	Passes A.C.S. Test	–	–
Ammonium hydroxide ppt.	–	–	–	–	–	0.10 %	–	–

Nickelous Acetate Reagent
Nickelous Ammon. Sulfate Reagent
Nickelous Carbonate Reagent
Nickelous Chloride Reagent and Purified
Nickelous Nitrate Reagent and Purified
Nickel Oxide Black Reagent
Nickel Oxide Green Reagent
Nickelous Sulfate Reagent

USES

- Ingredients of catalyst mixtures
- Textile mordants
- Reagent in metallized dye preparation
- Agents in nickel plating
- Agents in photo-engraving operations
- Process materials in paint and ceramic manufacture
- Agents in ferrite manufacture

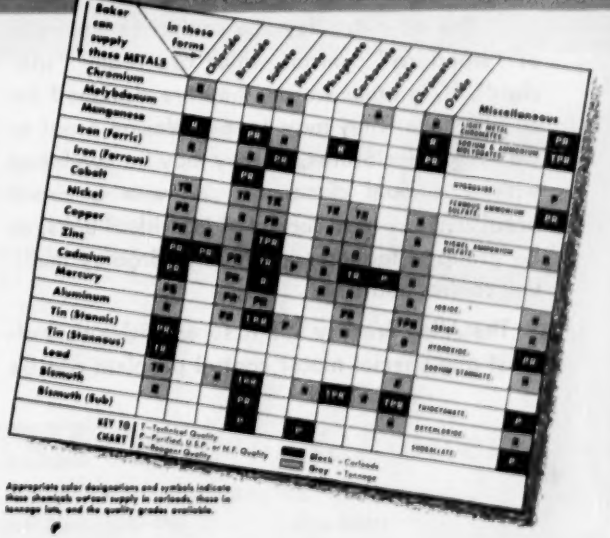
Analytical Determinations	Nickelous Chloride: Reagent Crystal Specif. Limit	Nickelous Chloride: Purified Crystal Typical Analysis	Nickelous Nitrate: Reagent Crystal Specif. Limit	Nickelous Nitrate: Purified Crystal Typical Analysis
Typical Nickel Content (as Ni)	24.4 %	24.2 %	20.1 %	20.0 %
Water Insolubles	0.005%	0.00 %	0.005 %	0.05%
Acid Insolubles	–	–	–	–
pH of 5% Solution	4.5-6.5	–	3.5-5.5	–
Chloride (Cl)	–	–	0.001 %	–
Nitrogen Compounds (as N)	0.005%	–	–	–
Ammonium (NH_4)	–	–	0.10 %	–
Sulfate (SO_4)	0.005%	–	0.002 %	–
Lead (Pb)	0.005%	–	0.003 %	–
Copper (Cu)	0.002%	0.005%	0.0005%	–
Cobalt (Co)	0.20 %	–	0.05 %	0.10%
Iron (Fe)	0.002%	0.04 %	0.001 %	0.04%
Zinc (Zn)	0.010%	–	0.010 %	–
Alkalies & Earths (as SO_4)	0.05%	0.12 %	0.10 %	0.15%

Cobalt Acetate Reagent and Tech.
Cobalt Carbonate Reagent and Tech.
Cobalt Chloride Reagent and Tech.
Cobalt Nitrate Reagent and Tech.
Cobalt Oxide Reagent
Cobalt Sulfate Reagent and Tech.

USES

- Driers in paints and varnishes
- Ingredients of catalyst mixtures
- Ingredients of mineral supplements
- Source of cobalt for alloys
- Source of cobalt for ceramics
- Binders in carbide tools
- Components of cermet thermistors

Analytical Determinations	Cobalt Acetate: Technical Crystal Typical Analysis	Cobalt Carbonate: Reagent Powder Specif. Limit	Cobalt Carbonate: Technical Powder Typical Analysis	Cobalt Chloride: Reagent Crystal Specif. Limit	Cobalt Chloride: Technical Crystal Typical Analysis	Cobalt Nitrate: Reagent Crystal Specif. Limit	Cobalt Nitrate: Technical Crystal Typical Analysis	Cobalt Sulfate: Technical Crystal Typical Analysis
Typical Cobalt Content (as Co)	23.8 %	24.7 %	47.0 %	24.5 %	24.0 %	20.2 %	20.2 %	25.7 %
Water Insolubles	0.01%	–	–	0.010%	0.02 %	0.010%	0.01%	–
Acid Insolubles	–	0.010%	–	–	–	–	–	–
pH of 5% Solution	–	–	–	4.0-6.0	–	4.0-7.0	–	–
Chloride (Cl)	–	0.002%	–	–	–	0.002%	–	–
Nitrogen Compounds (as N)	–	0.005%	–	–	–	–	–	–
Ammonium (NH_4)	–	–	–	0.005%	–	0.30 %	–	–
Nitrate (NO_3)	–	–	–	0.01 %	–	–	–	–
Sulfate (SO_4)	(0.39%	0.005%	0.02 %	0.005%	0.05 %	0.005%	0.01%	–
Lead (Pb)	–	0.005%	–	0.002%	–	0.002%	–	–
Copper (Cu)	0.01%	0.005%	0.01 %	0.002%	0.01 %	0.002%	0.01%	0.01%
Iron (Fe)	0.01%	0.005%	0.05 %	0.005%	0.05 %	0.005%	0.01%	0.01%
Nickel (Ni)	0.1 %	0.30 %	0.5 %	0.10 %	0.10 %	0.10 %	0.10%	0.25%
Zinc (Zn)	–	–	–	0.02 %	–	0.010%	–	–
Alkalies & Earths (as SO_4)	0.5 %	0.50 %	1.5 %	–	0.30 %	–	0.10%	0.50%
Subst. not ppt. by $(NH_4)_2S$ (as SO_4)	–	–	–	0.30 %	–	0.30 %	–	–
Arsenic (As)	–	–	0.001%	–	(0.01 %	–	–	–



Appropriate color designations and symbols indicate those chemicals certain supply in carloads, those in tonnage lots, and the quality grades available.

The chart shows the wide variety of heavy metal compounds Baker supplies in tonnage quantities, and the quality grades available.

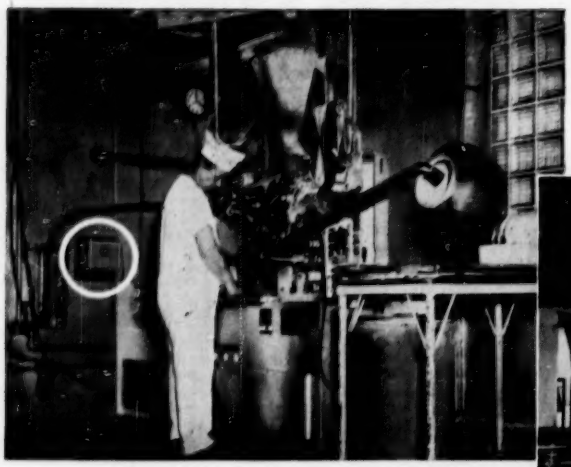
FREE REFERENCE FILE also contains availability charts of Baker Light Metal Compounds, Acids (Inorganic, Organic, Acid Anhydrides) and complete price schedules. For your copy send letter or postcard.

J. T. Baker Chemical Co.

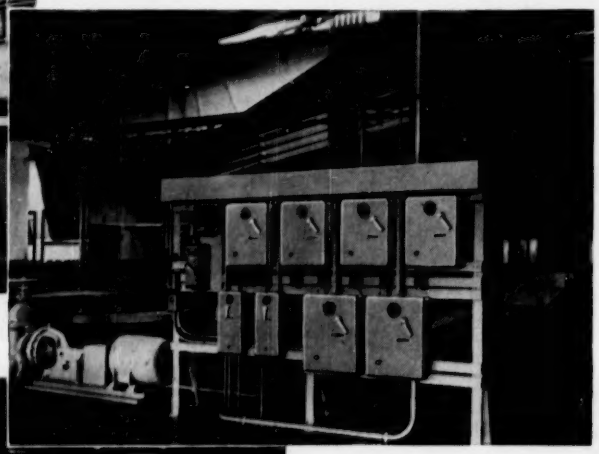
REAGENT · CHEMICAL · FINE · INDUSTRIAL

Phillipsburg, New Jersey

–for production use



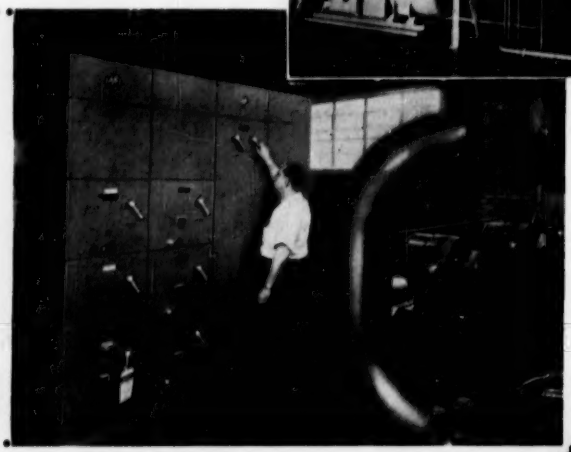
Encapsulating machine, in pharmaceutical plant, equipped with Allen-Bradley automatic starter.



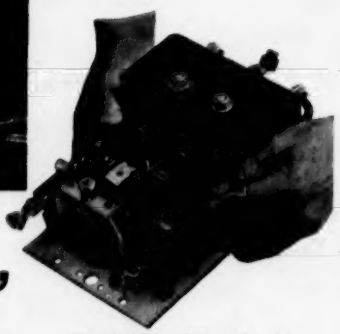
Allen-Bradley combination starters on spray booth control in large automobile plant.

The Sign of QUALITY CONTROL

A-B QUALITY



Allen-Bradley multi-unit control in large New Jersey brewery for controlling operation of pumps.



The Bulletin 709 solenoid starter—with only ONE moving part—assures millions of trouble free operations.

Special controls are "standard" with the Allen-Bradley line!

The Allen-Bradley line comprises hundreds of "standard" controls which are really "specials". . . in other words, they are designed for specific jobs. They may have explosion-proof or watertight enclosures, or they may be combined with a manual disconnect, or with a circuit breaker. They may consist of individual units, or be grouped together in an Allen-Bradley multi-unit control board.

The Allen-Bradley line is so extensive that almost any special motor control problem can be quickly solved with standard catalogued units.

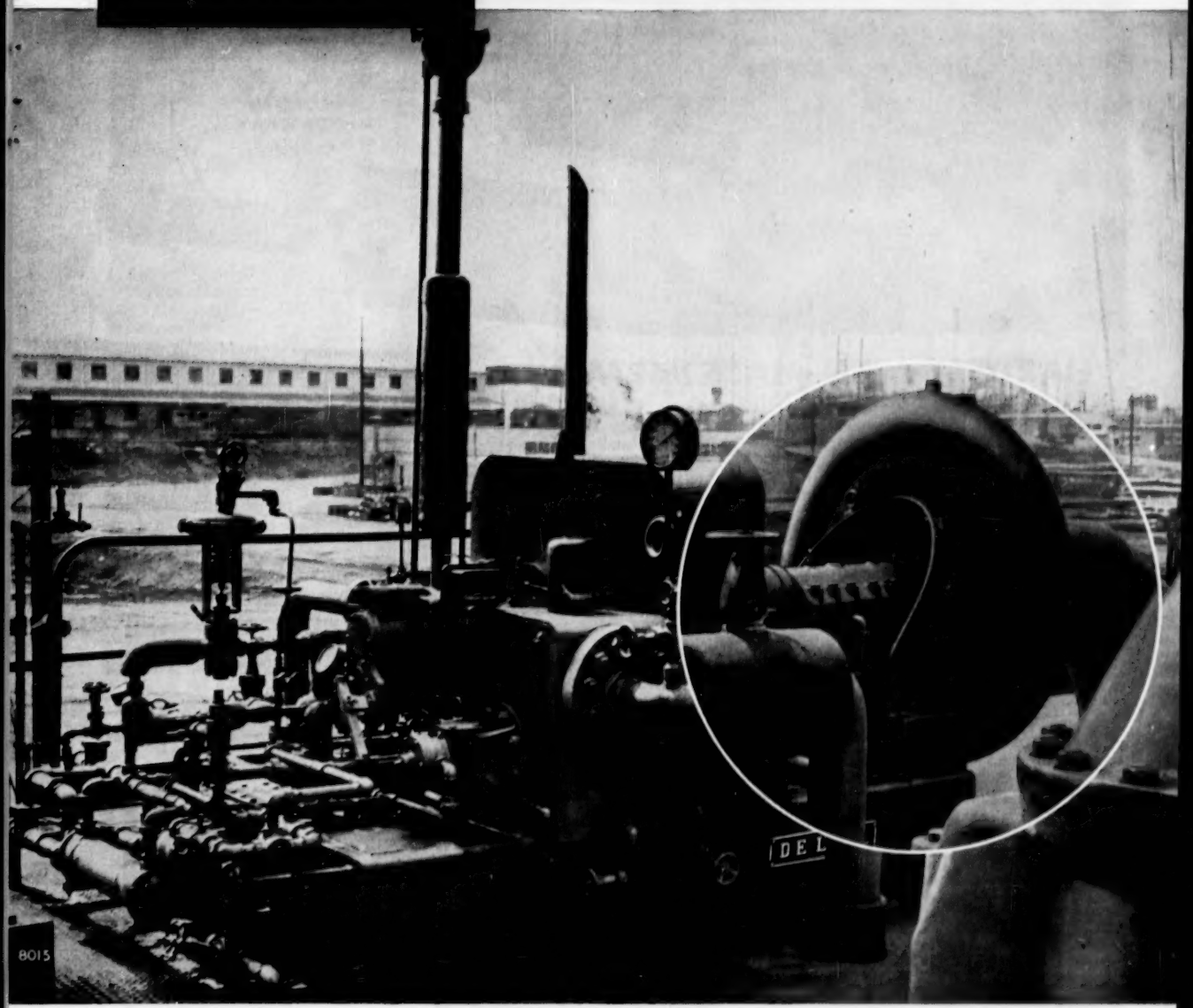
You should have the Allen-Bradley Handy Catalog on your desk . . . a 132-page encyclopedia of motor control data. Write, today.

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ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

DE LAVAL
CENTRIFUGAL
BLOWER

controls air in cat cracker at Standard Oil of California



This De Laval centrifugal blower, selected by the Fluor Corporation, is on stream at the Standard Oil Company of California's new cat cracker in El Segundo. For control air service, this blower delivers 9,500 cfm; inlet pressure is 15.4 psig and discharge pressure 19.4 psig. The blower is driven by a De Laval 220 brake horsepower MCP Turbine operating at 800 psig with a temperature of 650 F; it has all labyrinth shaft packing for high back pressure service.

In addition to single stage designs, De Laval makes a complete line of equipment for all refinery services, including multi-stage compressors driven by De Laval multi-stage turbines for condensing, non-condensing and automatic extraction applications.



Send for new Bulletin 0504

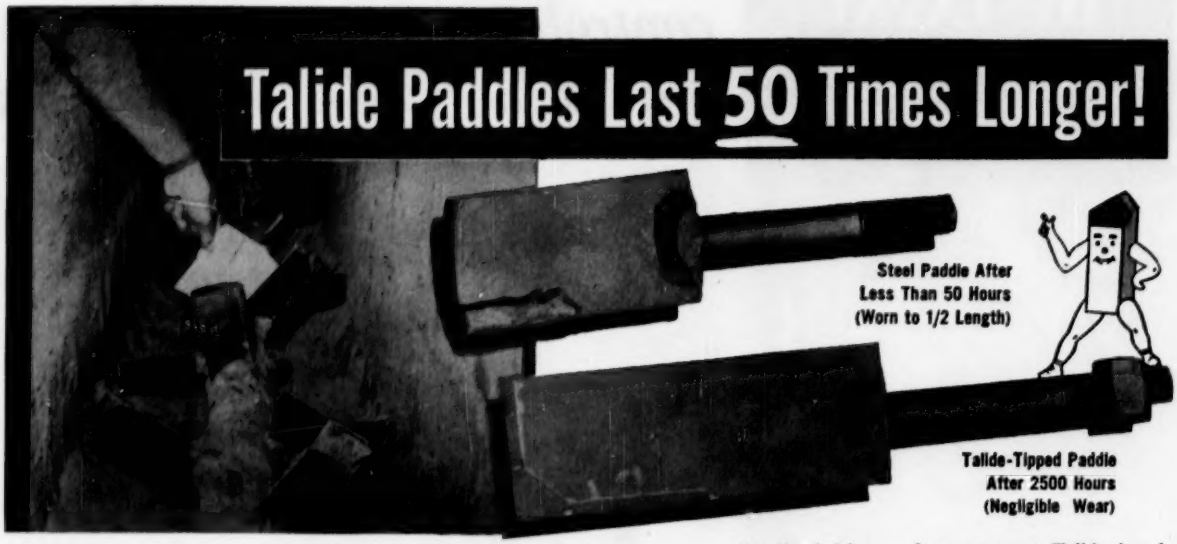
DE LAVAL *Centrifugal Blowers*

DE LAVAL STEAM TURBINE COMPANY

***803** Nottingham Way, Trenton 2, New Jersey*

DL 558

Talide Paddles Last 50 Times Longer!



HARDEST MAN-MADE METAL!

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain, and shock are destructive to other metals.

- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

ALL TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

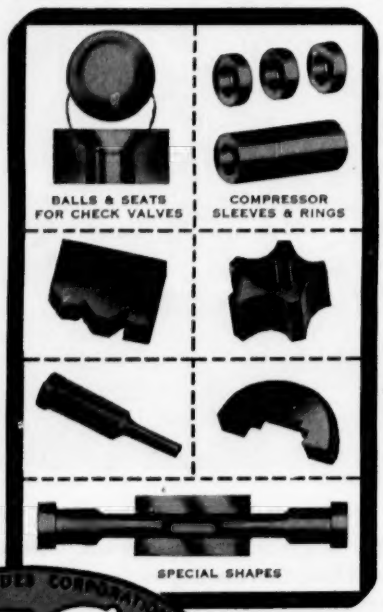
PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

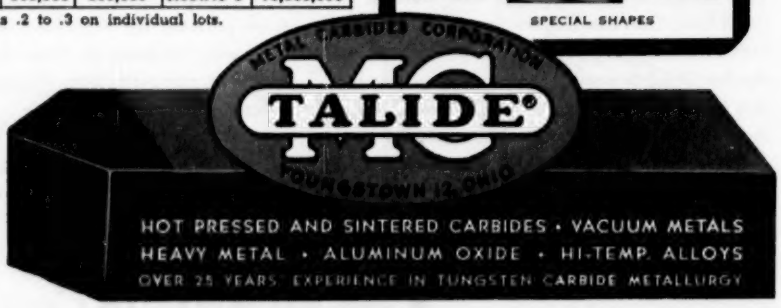
Leading brick manufacturer reports Talide-tipped pug mill paddles have outlasted 50 sets of hard-faced steel paddles to date—and are still in use. Operation involves mixing abrasive ceramic, clay and brick compositions.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, ceramic, mining and metalworking industry.



Send for new 76-page catalog 56-G or ask for sales engineer to call.

Metal Carbides Corporation
Youngstown 12, Ohio



THESE RESINS GIVE YOU NEW ANSWERS TO PRODUCT AND PROCESSING PROBLEMS



New improved Exon 900 series with tailored blending qualities means faster, more versatile production

... typical of the pin-pointed properties in Exon Vinyl Resins

Here is another addition to Firestone Exon's growing list of pin-pointed answers to specific problems: the new improved Exon 900 series.

These three new polyvinyl chloride resins offer many profitable advantages. The most important is greater versatility in both production and in the products you can make. For now Firestone gives you tailored blending to answer product and processing problems.

Firestone engineers have improved both the *absorptive* and *adsorptive* qualities of these new PVC resins. As a result, you get a greater pre-mix blending range, whether running hot or neutral. You can blend greater amounts of monomeric or polymeric plasticizer in the formulation. You get a wider area of temperature control.

To these temperature-tailored resins add the advantages of faster solvation, faster fusion rates in Banburys and mills, high quality, less fisheyes, greater product uniformity. New Exon 900 series resins give you greater dollar economies through quicker production.

Exon 911, 921 and 931 are just three of the resins in industry's most complete line of versatile vinyls. Another reason industry looks to Firestone Exon for engineered answers to its needs.

Consider your own production or product problem. Then for the resin properties pin-pointed to the best solution for you, check with Firestone.

Firestone
EXON
RESINS

For complete information and technical service, call or write:

CHEMICAL SALES DIVISION: **FIRESTONE PLASTICS COMPANY**

DEPT. 728M, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

IN CANADA, CONTACT CHEMICAL SALES DIVISION, FIRESTONE TIRE AND RUBBER COMPANY OF CANADA, LTD. HAMILTON, ONT.

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- Fuller's Earth
- Nickel Ores
- Copper

How Allis-Chalmers Can Help You

Cut Heat Transfer Costs

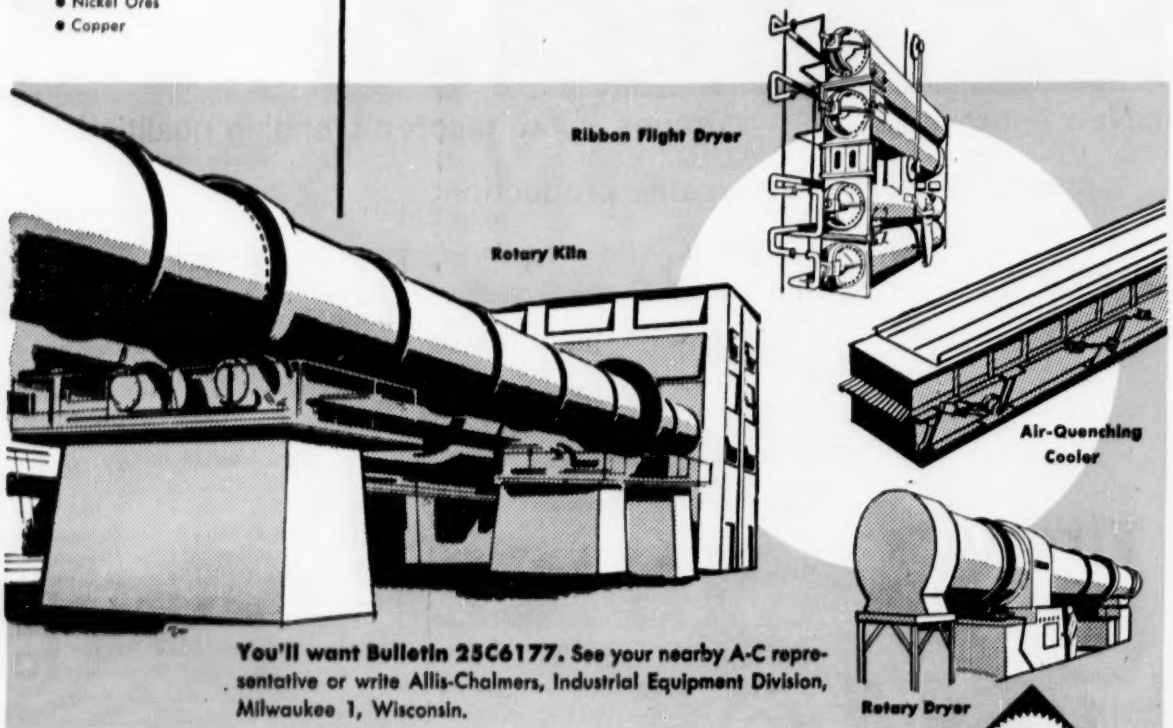
Obtaining increased production, lower processing costs and improved product quality is more than a matter of installing the best heat transfer equipment. Maximum utilization of that equipment also calls for an *efficient flow design.* You get *both* from Allis-Chalmers.

A-C Engineers Work With Your Staff or Consulting Engineers

Allis-Chalmers engineers concern themselves with overall operation . . . the evaluation of variables . . . plant design . . . the integration of interdependent equipment into a complete process.

Pre-recommendation research, testing and, of course, expert installation and localized field service are also available from Allis-Chalmers — the world's leading manufacturer of rotary kilns, coolers and associated equipment.

Equally important is the fact that Allis-Chalmers interest in your problems is continuous. Laboratory services, periodic equipment check-up and parts service are yours for the life of the equipment — and a long life it is, too.



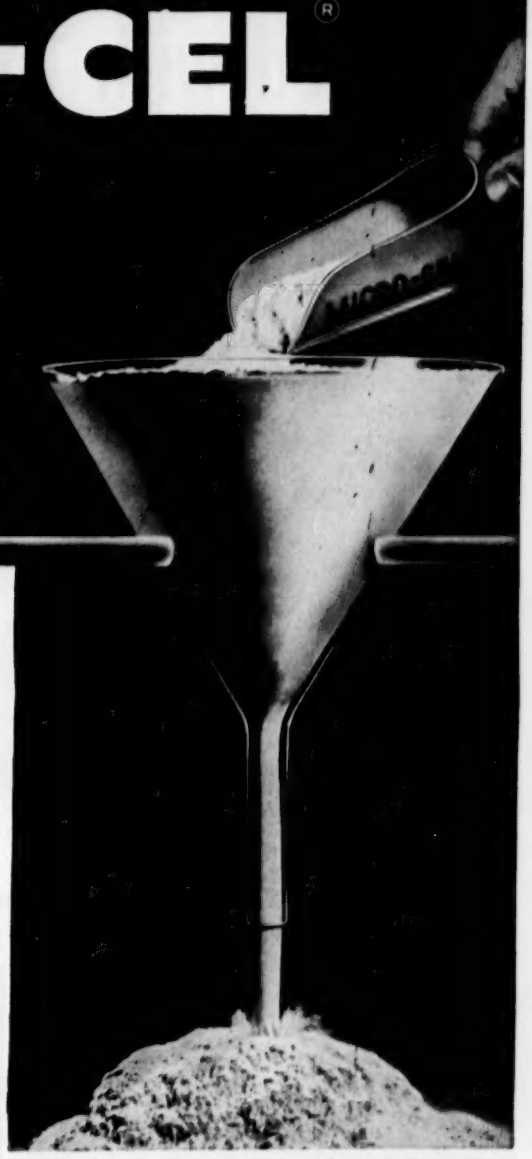
You'll want Bulletin 25C6177. See your nearby A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

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A-C ALLIS-CHALMERS A-5325

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- to absorb liquids
- to provide bulk
- to prevent caking
- to control viscosity
- to extend pigments
- to aid suspension
- to reduce surface sheen



New Johns-Manville mineral filler can help you improve products and cut costs

WANT to absorb liquids or control viscosity? Try *Micro-Cel*—it absorbs up to 6 times its weight in water, remains a free-flowing powder even after absorbing twice its weight in liquids.

Want to bulk up your compound for better control of package density? Try *Micro-Cel*—a cubic foot weighs as little as 5 pounds.

Want to prevent caking? Try *Micro-Cel*—its high absorption works wonders in controlling deliquescent products.

Want to extend pigments or reduce surface sheen? Try *Micro-Cel*—it combines fine particle size, large surface area and inertness with high absorption suggesting many applications.

Want to assure better suspension of heavy solids? Try *Micro-Cel*—its particle size, as low as .02 micron, provides uniform dispersion and blending.

Micro-Cel is a brand-new line of synthetic calcium silicates produced by combining lime with diatomaceous silica under carefully controlled conditions. Its unique combination of properties has already brought important benefits and savings to many processors. Maybe you will be next. Just mail coupon for further information, samples and technical assistance.

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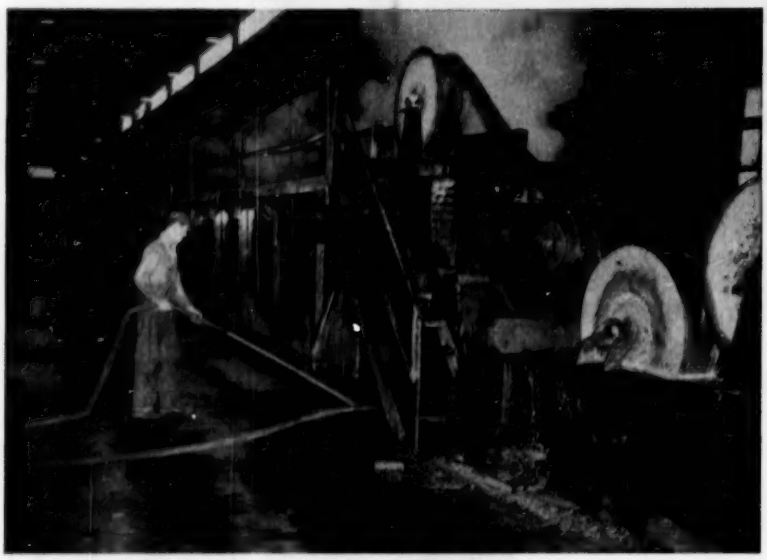
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New type industrial fire hose jacketed with 100% DACRON offers you all these advantages

REG. U. S. PAT. OFF.



THE LACLEDE STEEL COMPANY uses hose jacketed with 100% "Dacron" throughout the plant. This new hose works out exceptionally well in industries where exposure to acids and other degrading compounds is a problem.

- LIGHTWEIGHT, COMPACT
- ABRASION-RESISTANT
- RESISTANT TO MANY CHEMICALS
- WEATHER- AND MILDEW-RESISTANT

Now hose manufacturers make a fire hose that's ideal for general use around the plant. It's jacketed with 100% "Dacron"* polyester fiber and it offers unusual versatility because of the "just-right" balance of properties found in Du Pont "Dacron".

First of all, it's stronger hose (100% "Dacron" has more than 200 pounds' greater test strength than most conventional single-jacket hose) and yet it's about 25% lighter. It is easier to handle, and much more flexible than previous types.

Hose jacketed with "Dacron" is economical to use for maintenance jobs because of its high abrasion resistance. It stands up under day-after-day exposure to most chemicals, too. Hose jacketed with "Dacron" has good resistance to salt water, alcohols, oils, hydrocarbons and detergents. And this new type of hose *can't be weakened by mildew.*

Du Pont makes "Dacron" fiber, but does not manufacture hose. We'll be glad to send you the names of manufacturers of hose jacketed with 100% "Dacron". Write: E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Department, Wilmington 98, Delaware.

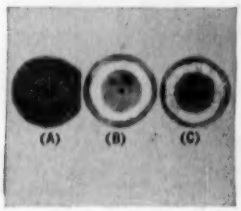
*"DACRON" IS DU PONT'S REGISTERED TRADEMARK FOR ITS POLYESTER FIBER.

PROVED: Tests show how "DACRON" gives improved performance . . .



SOIL-BURIAL TEST.

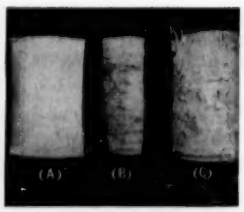
The two samples shown were buried in moist, warm soil for 28 days. When removed, the conventional hose specimen (right) showed signs of damage by bacterial and mold colonies. The specimen with jacket of 100% "Dacron" (left) did not support the growth of microorganisms and was merely soiled.



TABER ABRASION TEST.

In this test, hose specimens were compared for resistance to abrasion. Each test was stopped at the point where the hose had theoretically reached its maximum service life. (A "cycle" represents one complete revolution of the abrading wheel.)

(A) Rubber-covered conventional hose . . . . . 4,150 cycles
(B) Single-jacket hose of "DACRON" . . . . . 12,500 cycles
(C) Conventional single-jacket hose . . . . . 1,830 cycles



CHEMICAL-RESISTANCE TEST.

Here's what happened when three common types of industrial fire hose were immersed in a 17% solution of sulfuric acid for 24 hours.

(A) 2½" hose, single jacket of "Dacron", no apparent damage.
(B) 1½" hose, conventional jacket, damaged.
(C) 2½" hose, "Dacron" and conventional fiber, no damage to "Dacron".



FREE BOOKLET...

tells you more about the properties of hose made with "DACRON". For your copy write to: E. I. du Pont de Nemours & Co. (Inc.), 5520 Nemours Building, Wilmington 98, Delaware.

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LATTICE-BRAID Asbestos Packing with Teflon impregnation reduces friction, provides better seal with less gland pressure.

Wherever corrosion, contamination or torque is a problem on reciprocating applications or slow-turning valves CHEVRON Packing made of Teflon is recommended.

Centrifugal pumps handling hot sulfuric acid and petroleum fractions leaked badly with ordinary packing. Also, new shaft sleeves required every few days. Teflon packing reduced leakage, and after several months service both packing and shaft were still in good condition.

Teflon packing rings on duplex pump handling 50% sodium hydroxide at 270°F showed no sign of wear after 5 months. Formerly, packing lasted average of 30 days.

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For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada. For information on other fluorocarbon plastic products contact United States Gasket Company, Plastics Division of Garlock.

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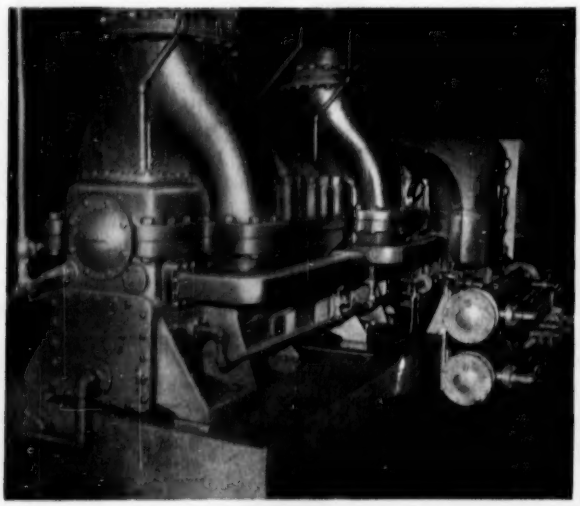
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Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products

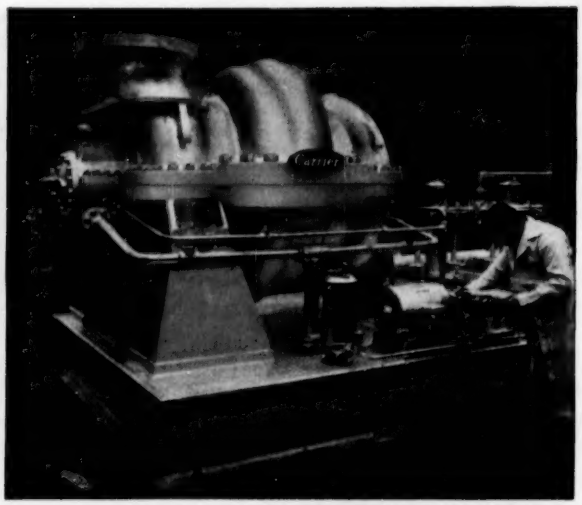
Which is the best way to compress gases against high compression ratios?

There are many factors to consider. Here's one: How many gases are being compressed—one, two or more? With a wide selection of compressors and arrangements, Carrier has the right answer for your application. What's more, with greater experience handling more different gases in its compressors than any other manufacturer, Carrier offers application skill unmatched in the industry. Two of many Carrier compressors are shown below. For complete information about them, call your nearest Carrier office.

Or write Carrier Corporation, Syracuse, N. Y. Carrier



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About the Cost of Living . . . with Steam Traps

WHEN YOU specify steam traps, what could possibly be more important than *the cost of living with them* — production cost . . . steam cost . . . downtime cost . . . repair cost.

No steam traps manufactured have ever provided greater equipment operating efficiency or lower trap maintenance cost than Armstrongs.

Consider the experiences of these companies:

"30% Greater Output from platen presses since installing Armstrong Traps" — rubber processor.

"$8000 Annual Fuel Saving since replacing 600 traps with Armstrong" — metal processor.

"30% Less Downtime for repairs with Armstrong Traps" — food processor.

"$25,000 Trap Maintenance Saving every year since installing 4000 Armstrong Traps" — major chemical plant.

You may well ask, "Can there really be so big a difference in steam trap performance?" The answer is: These are typical experiences of people who have compared Armstrong trap performance — not for a month or a year, but over periods of 2, 5 and even 10 years or more.

The Armstrong trap has certain fundamental advantages, including:

No Steam Loss — the valve is always water-sealed.

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Long-life parts — hardened chrome steel valve and seat — all other parts corrosion-resistant stainless. Absolutely nothing to stick, bind, clog or collapse. Not affected by ordinary dirt and scale.

Unconditionally guaranteed to satisfy. It takes an awfully good product to carry such a guarantee.

Steam traps can have such a big effect on plant operating efficiency, they are worth more than casual consideration. Let your Armstrong Factory Representative answer your questions. There is no obligation. Call him or write:

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Do you have "The Steam Trap Book"? — 44 pages of useful data on trap sizing, calculation of condensate loads, installation and maintenance. Free on request.

ARMSTRONG STEAM TRAPS

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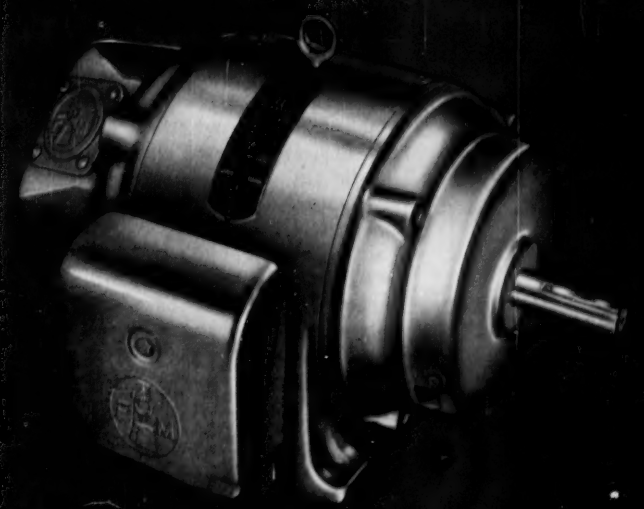
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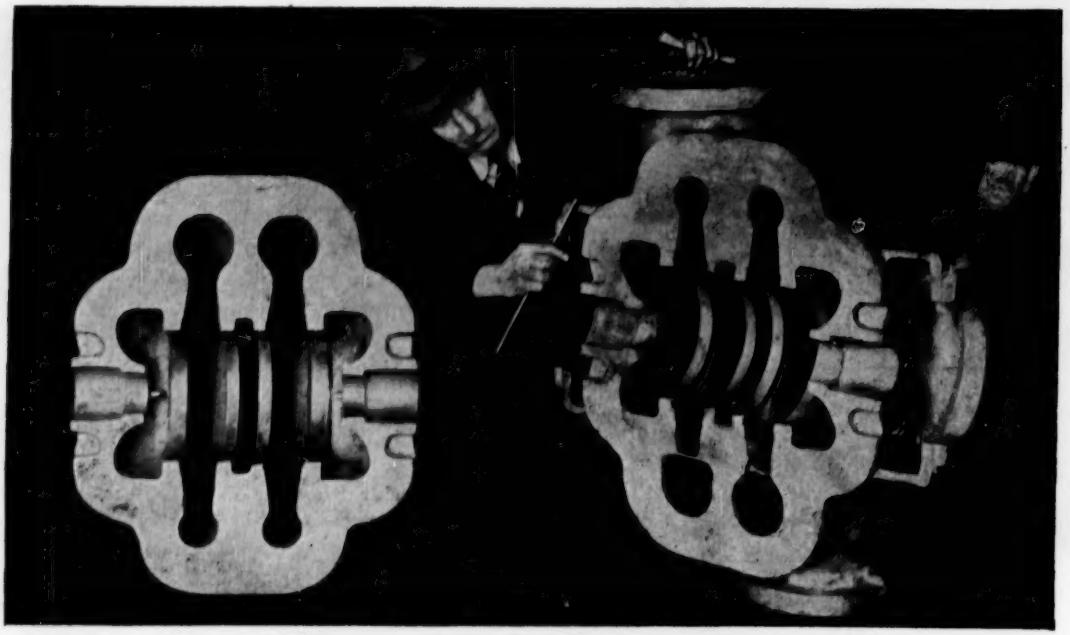


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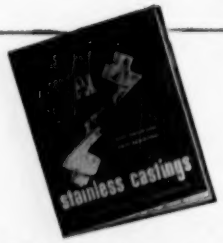
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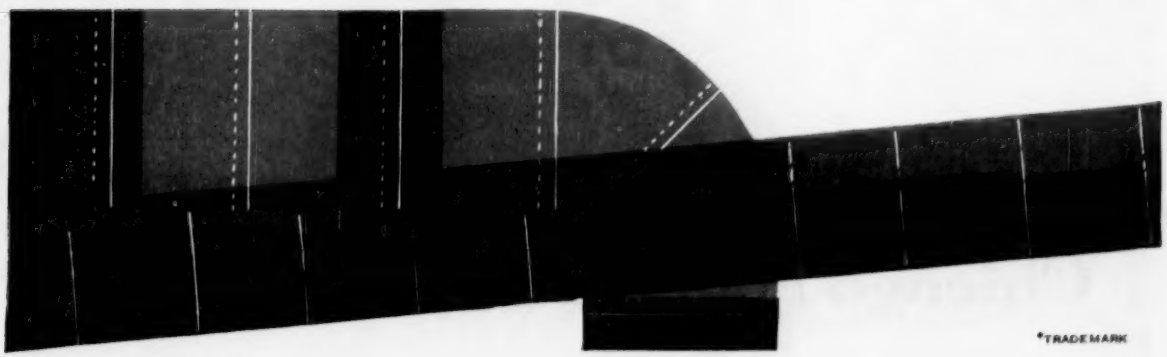
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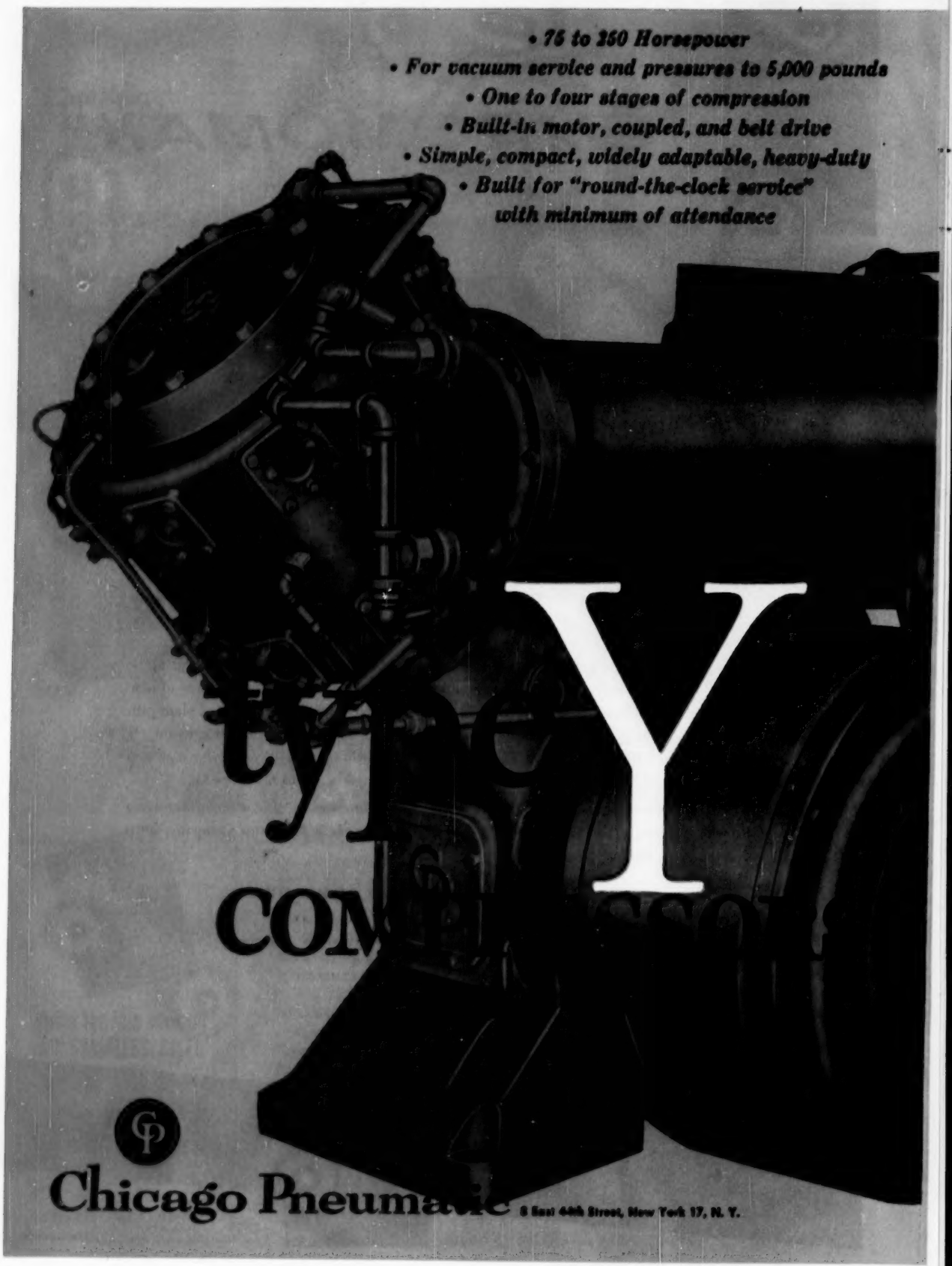
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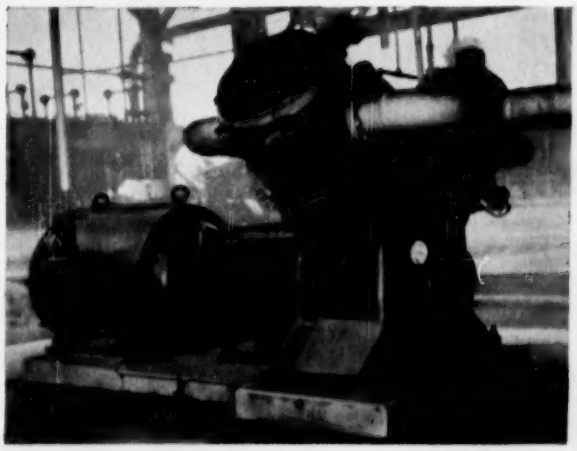
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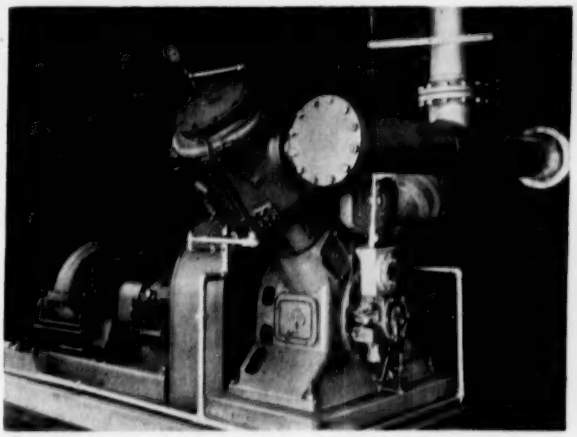
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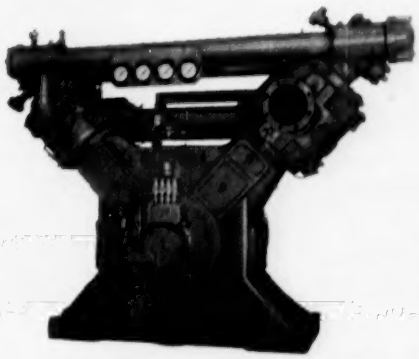




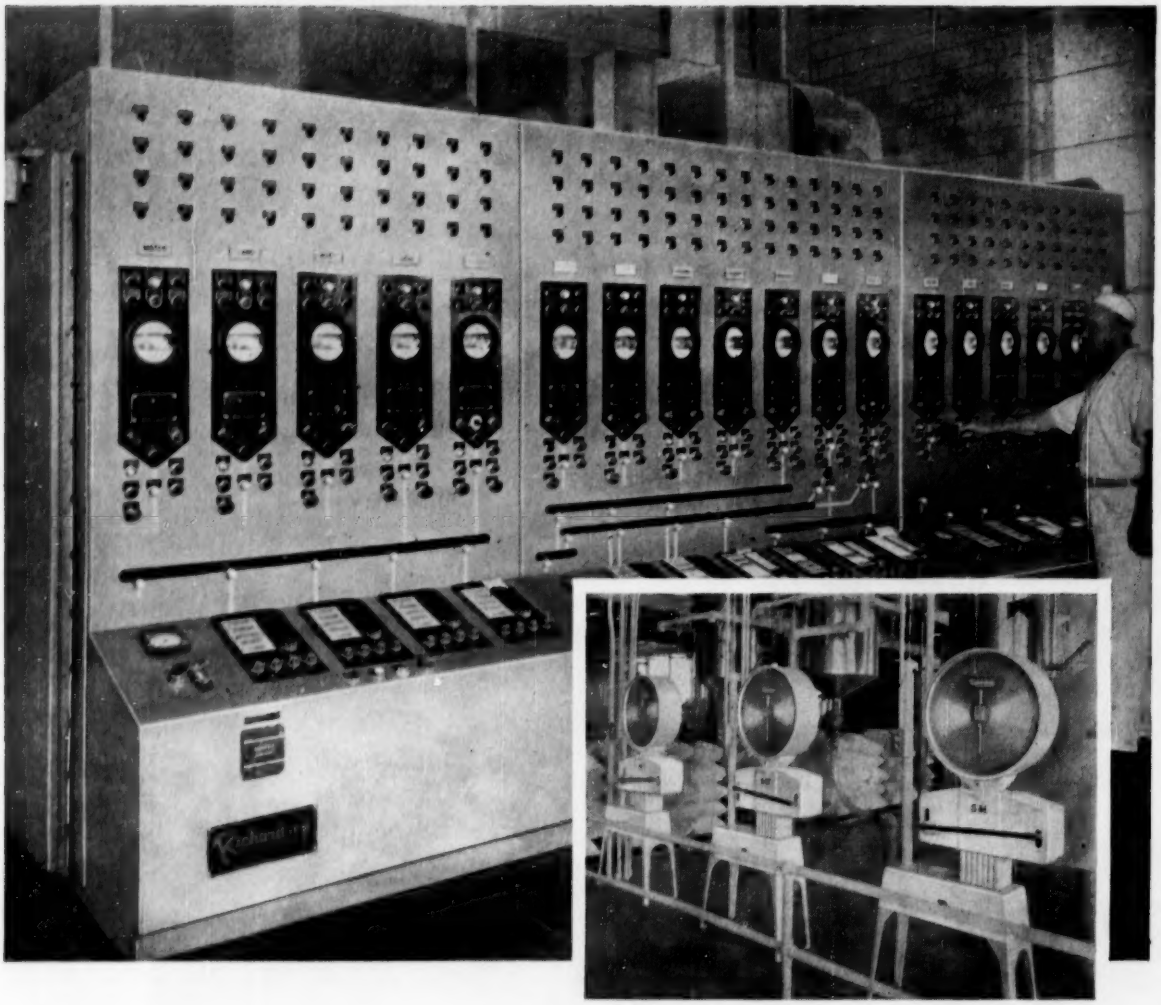
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This Richardson Select-O-Weigh system is the most complete automatic proportioning panel yet installed in the food industry.

Coupled with a conveying system, the panel controls automatic feeding of material from any of 14 flour bins, two sugar bins, and storage tanks for shortening, invert, molasses, and water. With this system, the bakery can proportion three different formulas simultaneously. Every phase of operation is clearly indicated on the panel by means of signal lights, which graphically reflect actual material flow. Ingredients can be delivered in the sequence and proportions called for by a specified formula. When each phase of this operation is completed, a signal light on the panel notifies the operator. When an ingredient is delivered to the mixer, a light beside the panel card on the board flashes. The operator knows at all times the progress of each formula being delivered to the mixers.

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For additional information on this interesting installation, and engineering assistance in automating your operation, write Richardson Scale Company, Clifton, New Jersey.

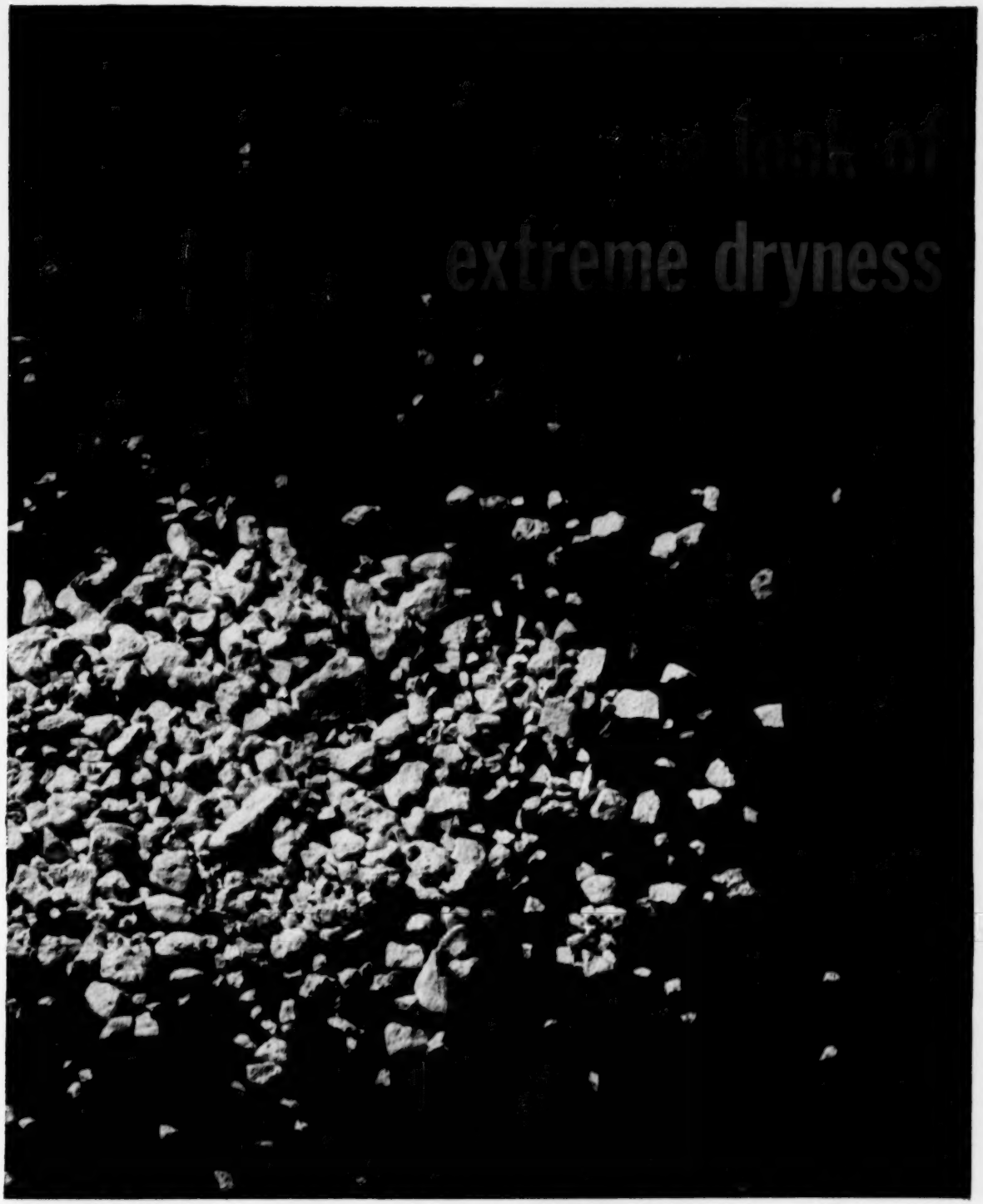
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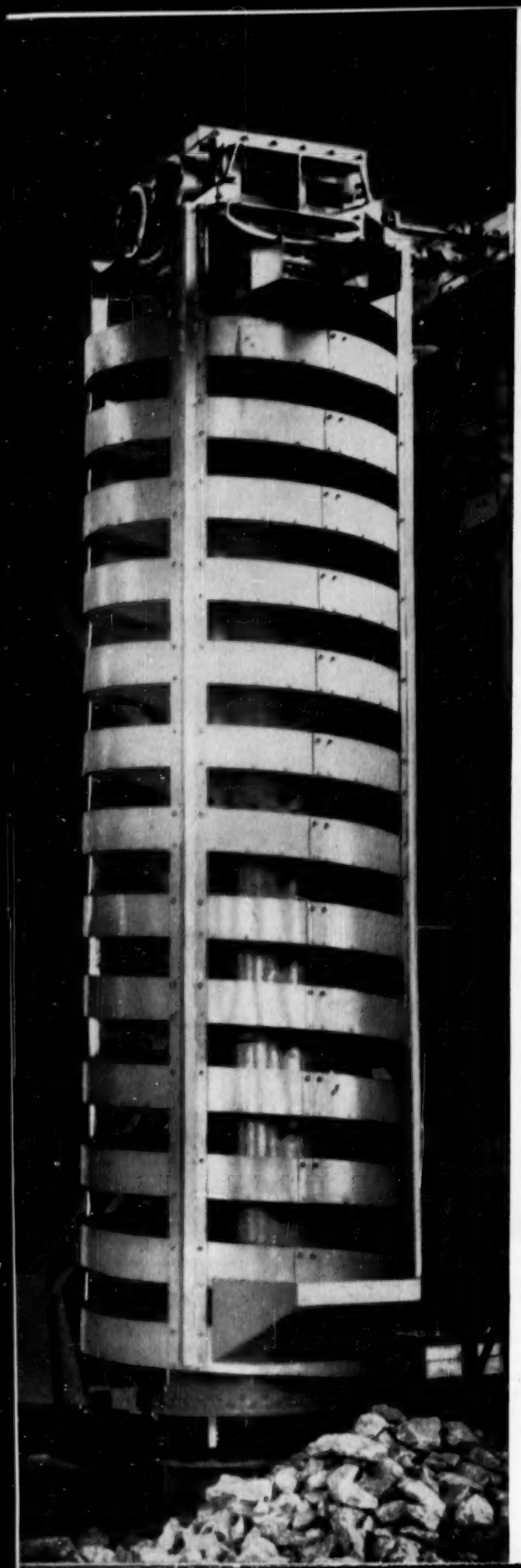
for gases, liquids & vapors—Looking for an efficient, *economical* adsorbent to obtain extreme dryness in gases, liquids or vapors? Then look to ALCOA® Activated Alumina, the oldest, most thoroughly proved commercial adsorbent available.

ALCOA Activated Alumina dries to lower dew points (minus 100°F and lower) than any other commercial desiccant. Nontoxic, noncorrosive and chemically inert, it relieves you of contamination worries and eliminates many serious maintenance problems. Because it remains fully effective through almost unlimited saturation-reactivation cycles, it insures lowest possible dehydration costs.

Let ALCOA help you solve your dehydration problems. Get complete information today on the properties and performance of ALCOA Activated Alumina. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 702-K Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA CHEMICALS

NEW! "ALCOA THEATRE" Exciting Adventure Alternate Monday Evenings



new . . .

DRAVO-SCHENCK

helical conveyors vibrating screens and conveyors

Through an exclusive agreement, Dravo Corporation is now licensed to manufacture vibro-conveyor equipment based on the original designs developed and patented by the Carl Schenck Company of Darmstadt, Germany.

The helical type conveyor operates vertically in a space saving spiral and handles bulk material up to four inches in diameter. Employing a unique mechanically operated "Micro Thrust" exciter unit, Dravo-Schenck screens, feeders and conveyors have a wide variety of applications in the handling of chemicals, cement clinker, ferrous and non-ferrous sintered ores, coal, crushed stone, abrasive or other difficult-to-handle material.

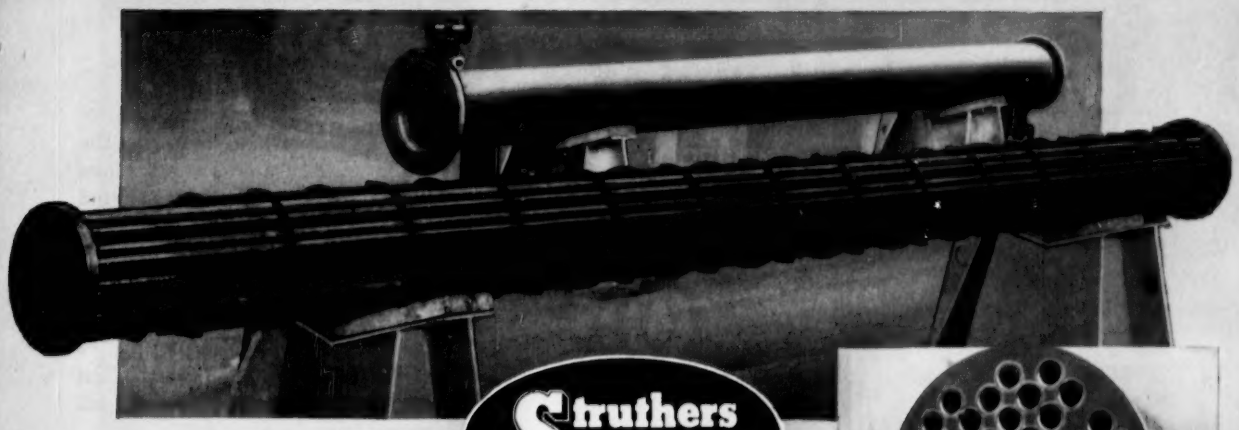
Our engineers will confer with you on specific problems. Complete information on this equipment is available. Write for Bulletin No. 1475, Dravo Corporation, Pittsburgh 22, Pennsylvania.

DRAVO

CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels space heaters • steel grating • towboats, barges, river transportation

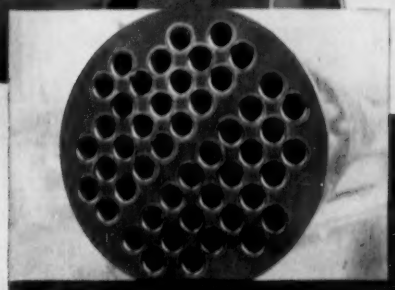
Experienced...

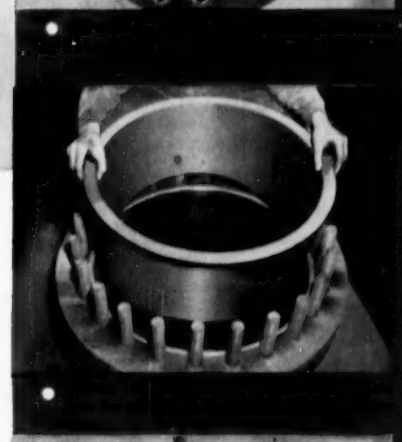


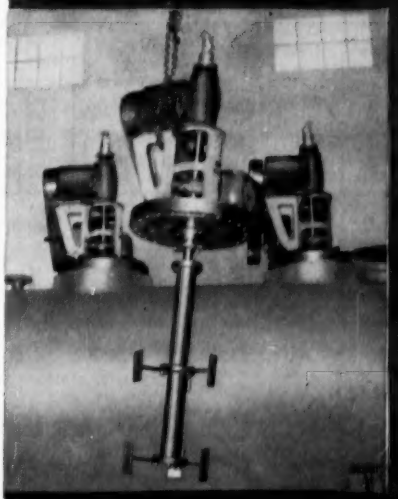
Struthers Wells

Titanium Fabrication

for the processing industries







TITANIUM—the upcoming metal of the times for corrosion-resistance—requires experienced skill for fabrication into precision equipment for the processing industries. Struthers Wells has gained that experience from the inception of commercial quantities of the metal. The several pieces of equipment shown are typical of the precision equipment built by SW with this new strategic metal. When the corrosion-resistance of TITANIUM fits your need —see Struthers Wells for your equipment.

STRUTHERS WELLS *Corporation*

Struthers Wells

WARREN, PA.

Plants at Warren and Titusville, Pa.

Representatives in Principal Cities

STRUTHERS WELLS PRODUCTS

PROCESSING EQUIPMENT DIVISION—Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

BOILER DIVISION—BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube Package Units

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MACHINERY DIVISION—MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

YTTRIUM

Availability of high purity yttrium and rare earth oxides

A report by LINDSAY

Only three years ago, most high purity rare earths were little more than laboratory curiosities.

Today they are extensively used for an amazing variety of chemical and industrial applications.

What happened? Lindsay technicians pioneered the first commercially installed ion exchange unit for the production of separated rare earths. The process was patterned after techniques developed by Doctors Spedding and Powell of the Institute for Atomic Research at Ames, Iowa.

Lindsay's pilot plant rare earth ion exchange installation had 40 six-inch columns. This unit made purified rare earths available to industry for the first time in practical, even though still limited, quantities.

The response from industry was so enthusiastic, we were forced to expand our ion exchange facilities rapidly. Today we have in continuous operation more than 100 columns with large production units of eighteen-inch and sixty-inch diameters.

With our larger production facilities, we are now making prompt shipments of high purity yttrium and rare earth oxides in quantities from a gram to hundreds of pounds.

TYPICAL MAXIMUM IMPURITIES IN LINDSAY PURIFIED RARE EARTH AND YTTRIUM OXIDES

ATOMIC NO.	OXIDE	CODE	PURITY	% RARE EARTH MAXIMUM IMPURITIES AS OXIDES
57	La_2O_3. LANTHANUM OXIDE	528 529	99.99 99.997	0.01 Pr, 0.001 Ce. 0.0025 Pr, 0.0005 others
58	CeO_2. CERIC OXIDE	215 216	99.8 99.9	0.2 (largely La + Pr + Nd). 0.1 (largely La + Pr + Nd).
59	Pr_6O_{11}. PRASEODYMIUM OXIDE	726 729.9	99 99.9	1 La + Nd + smaller amounts of Ce and Sm. 0.1 Ce + Nd.
60	Nd_2O_3. NEODYMIUM OXIDE	628 629 629.9	95 99 99.9	1-4 Pr, 1-4 Sm, 0.5-1 others. 0.1-0.4 Pr + 0.1-0.4 Sm + 0.5 others. 0.1 (largely Pr + Sm).
62	Sm_2O_3. SAMARIUM OXIDE	822 823	99 99.9	0.2-0.7 Gd, 0.2-0.6 Eu, and smaller amounts of others. 0.1 (largely Nd + Gd + Eu).
63	Eu_2O_3. EUROPIUM OXIDE	1012 1011	98-99 99.8	1-2 Sm + smaller amounts of Nd + Gd + others. 0.2 (largely Sm + Gd + Nd).
64	Gd_2O_3. GADOLINIUM OXIDE	928.9 929.9	99 99.9	1 Sm + Eu + trace Tb. 0.1 Sm + Eu + trace Tb.
65	Tb_4O_7. TERBIUM OXIDE	1803 1805	99 99.9	1 Gd + Dy + Y. 0.1 Gd + Dy + Y.
66	Dy_2O_3. DYSPROSIUM OXIDE	1703 1705	99 99.9	1 (largely Ho + Y + Tb + small amounts of others). 0.1 Ho + Y + traces of others.
67	Ho_2O_3. HOLMIUM OXIDE	1603 1605	99 99.9	1 (largely Er + Dy + small amounts of others). 0.1 Er + Dy + traces of others.
68	Er_2O_3. ERBIUM OXIDE	1303 1305	99 99.9	1 Ho + Dy + traces Yb and Y. 0.1 Ho + Tm.
69	Tm_2O_3. THULIUM OXIDE	1405 1403	99.9 99	0.1 Er + Yb + trace Lu. 1 Er + Yb + trace Lu
70	Yb_2O_3. YTTERBIUM OXIDE	1201 1202	99 99.9	1 Er + Tm + trace Lu. 0.1 Tm + trace Lu + Er.
71	Lu_2O_3. LUTETIUM OXIDE	1503 1505	99 99.9	1 Yb + Tm + traces of others. 0.1 Yb + Tm + traces of others.
39	Y_2O_3. YTTRIUM OXIDE	1112 1115 1116	99 99.9 99.9+	1 Dy + Gd + traces Tb and others. 0.1 Dy + Gd + traces Tb Approx. 0.05 Dy + Gd.

COSTS GREATLY REDUCED

Of course, as production of purified rare earths increased, costs came down. For example, only three years ago Terbium Oxide cost $500 a gram. Today you can obtain moderate size lots at less than $3 a gram.

Now that you know these high purity oxides are so readily available and the cost so remarkably low, what are *you* waiting for?

Rare earths, in purities up to 99.99%, have captured the interest and imagination of scientists in many industries as valuable new tools for the improvement of processes and products.

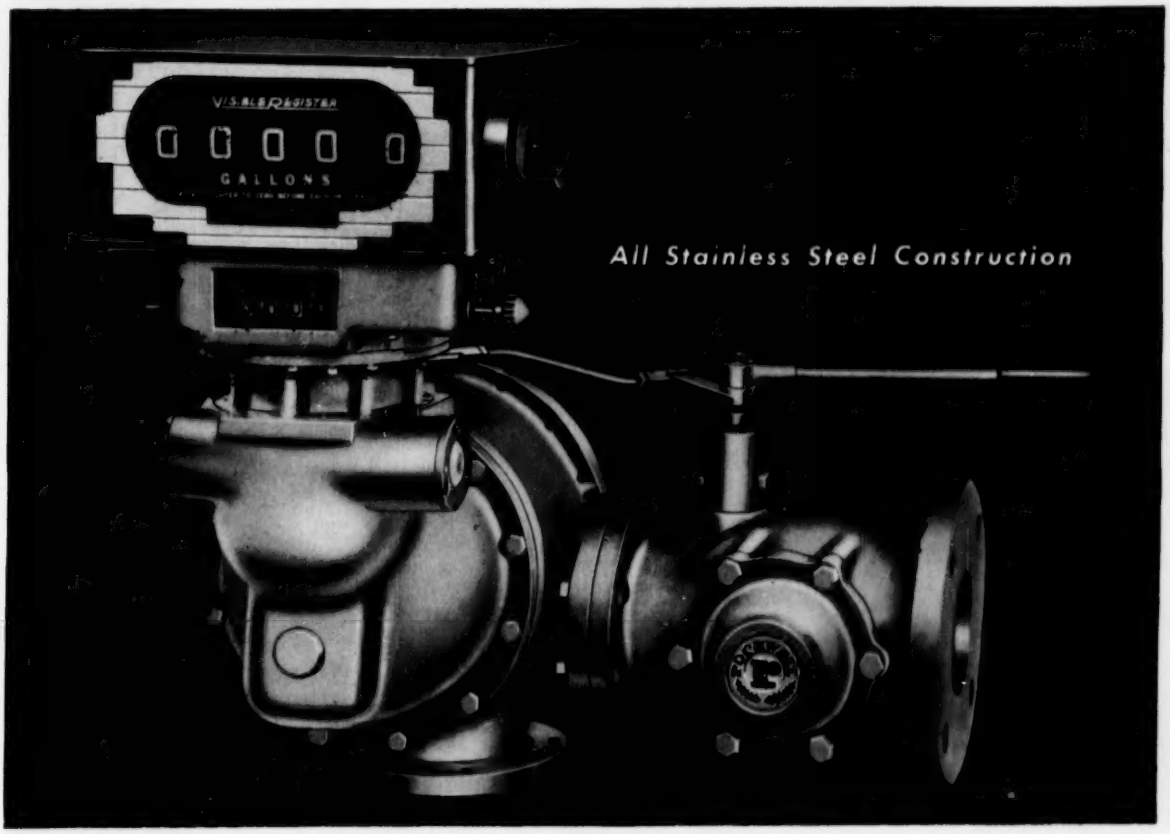
Your research, product development and production people should investigate the possibilities of these materials. Our bulletin "Purified Rare Earth and Yttrium Oxides" will give you detailed information and prices.

PLEASE ADDRESS INQUIRIES TO

LINDSAY CHEMICAL COMPANY

286 ANN STREET • WEST CHICAGO, ILLINOIS

Now! Automatic Quantity Control for Corrosive Liquids



"On the nose" measurement with smooth multi-stage shut-off

This efficient, Rockwell *stainless steel* meter-control system will save money for you who batch, blend or otherwise process foods, pharmaceuticals, chemicals, liquors, etc. It's immune to corrosive attack!

To operate you simply pre-set the quantity you wish to measure on the register. When this quantity has been reached, the flow stops. The automatic control valve is of the multi-stage type so the shut-off is made without hydraulic shock. Simple electrical controls are available for repetitive operation.

Rockwell also makes this automatic quantity control unit in bronze, steel or all-iron construction. Use the handy coupon for full details.

Rockwell

STAINLESS STEEL METERS

with quantity control valve

—CLIP COUPON—MAIL TODAY—

ROCKWELL MANUFACTURING COMPANY Dept. 104K
Pittsburgh 8, Pennsylvania

Gentlemen:

I am interested in measuring _____
(Name of liquid)

Pipe Size _____"

Working Pressure _____ psi. Temperature _____ °F max.

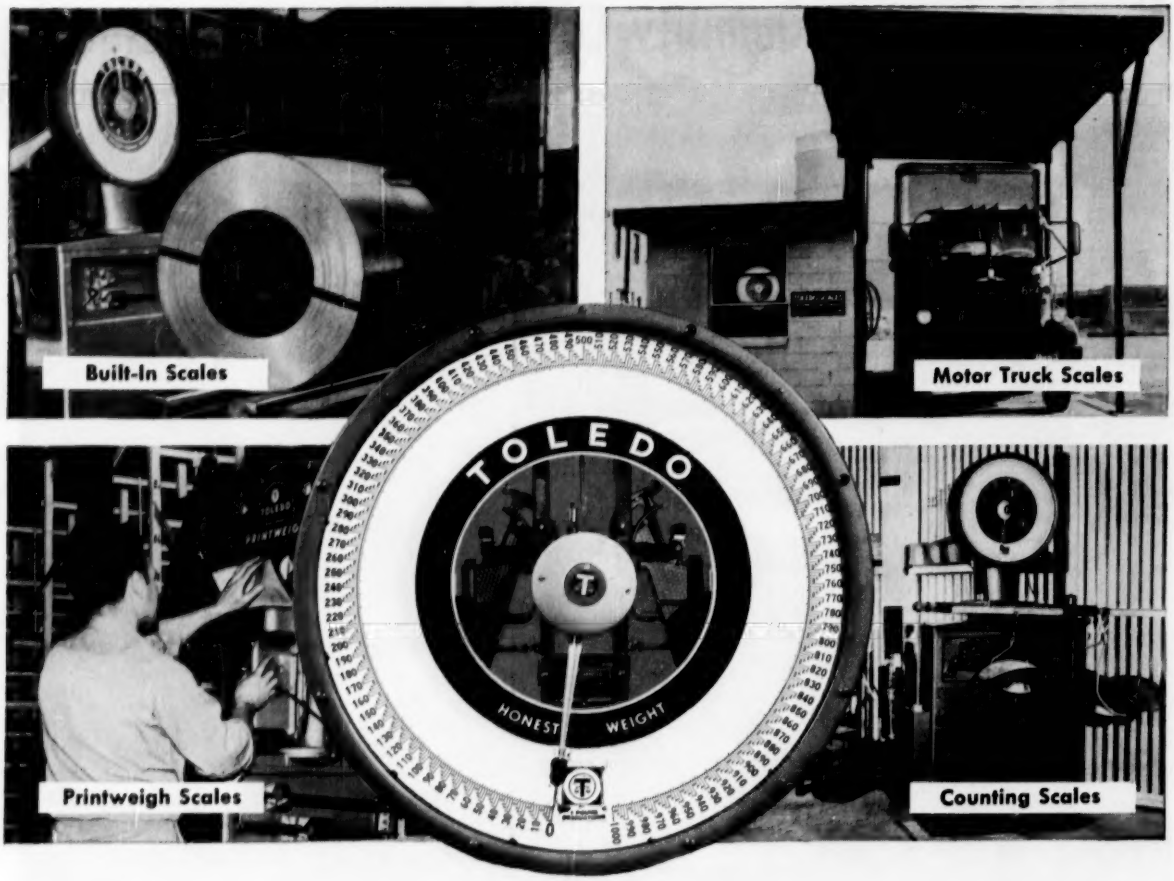
Max. Flow Rate _____ gpm. Min. Flow Rate _____ gpm.

Your Name _____

Company _____

Street _____

City _____ Zone _____ State _____



For new ways to control your costs . . .

take a Plant-Wide Look at Weighing!

What's the status of weighing in *your* plant? It's important to know because weighing is a vital element in the overall cost control system. Weight records directly affect costs, quality, inventory control and customer billing. Weighing errors—or inadequate weight data—set the stage for losses in output, profits and customer good-will.

This calls for integration of weighing in a plant-wide weighing system . . . the right scales in the right places . . . to supply basic records on materials received, processed, shipped or transferred.

To learn the job your scales are now doing, we invite you to send for the new Toledo Weight Fact Kit. It will help you determine how well your scales measure up as a weighing system—help you detect weighing inefficiencies that drain profits.

REQUEST YOUR WEIGHT FACT KIT NOW. No obligation. Address Toledo Scale Company, 1403 Telegraph Road, Toledo 13, Ohio.

TOLEDO® HEADQUARTERS FOR WEIGHING SYSTEMS

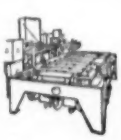
CUSTOM PRODUCTS FOR INDUSTRY



REMOTE DIGITAL WEIGHTS. Toledos automatically transmit weights to electric office machines located anywhere.



ELECTRONIC SCALES give electronic wings to weights; head may be located anywhere.



TESTING Toledos today test a wide range of parts; this device for leaf springs.



AUTOMATIC BATCHING SYSTEMS interlock batteries of scales.



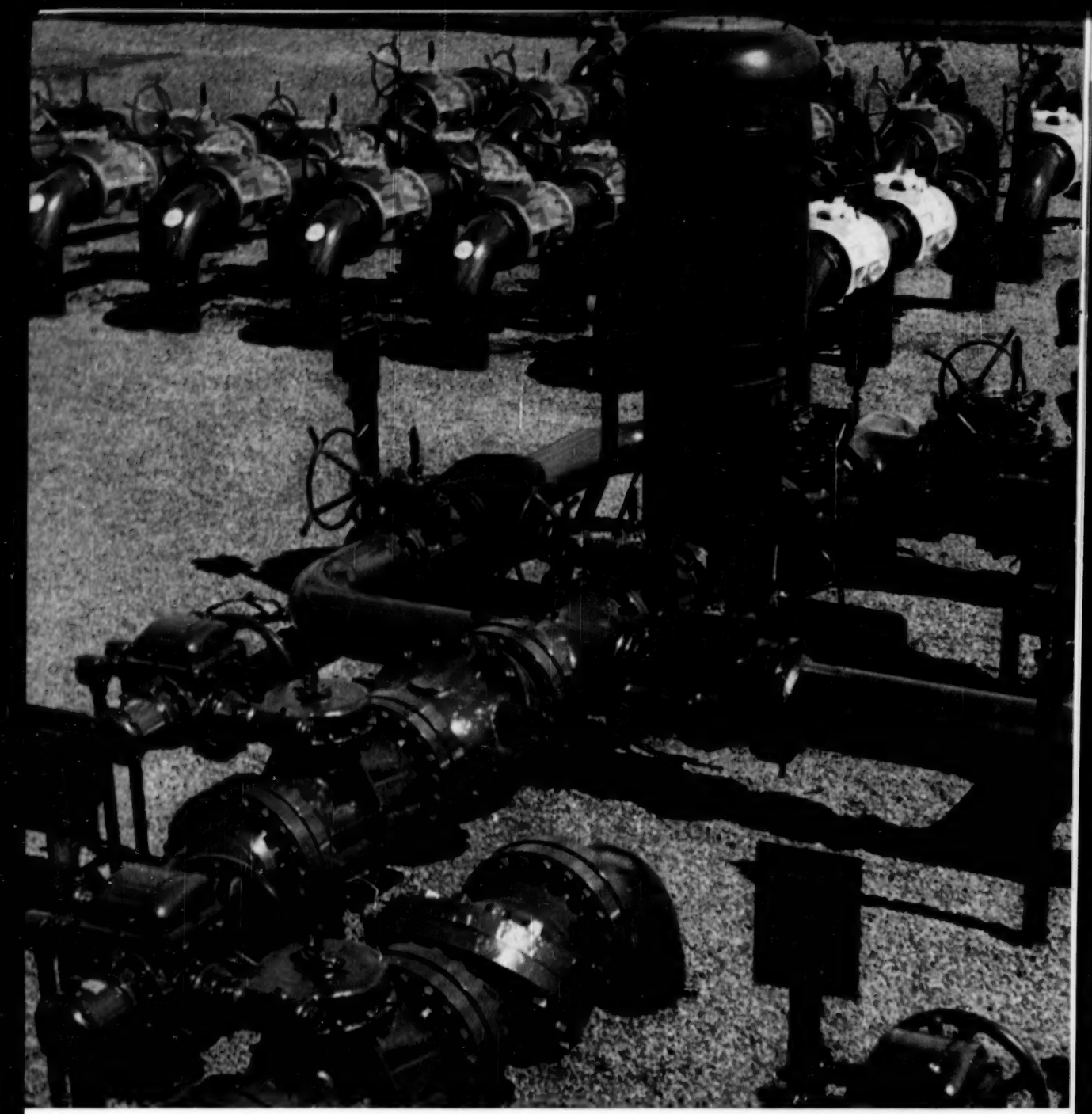
TROUBLE FREE... You can't buy a more trouble-free, leak-proof valve than Rockwell-Nordstrom; that has been proven over the last 40 years. The basic reasons: a durable, *pressurized lubricant* seal holds the lightest gases or heaviest slurries bottle tight. And, *lubricant protection* eliminates metal-to-metal wear —prevents valve failure, keeps maintenance costs lower than any other valve.

Rockwell-Nordstrom, the world's most complete line of lubricated plug valves, will give you better flow control at lower cost everywhere you use them. And they cost no more to buy, often less, than ordinary valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off



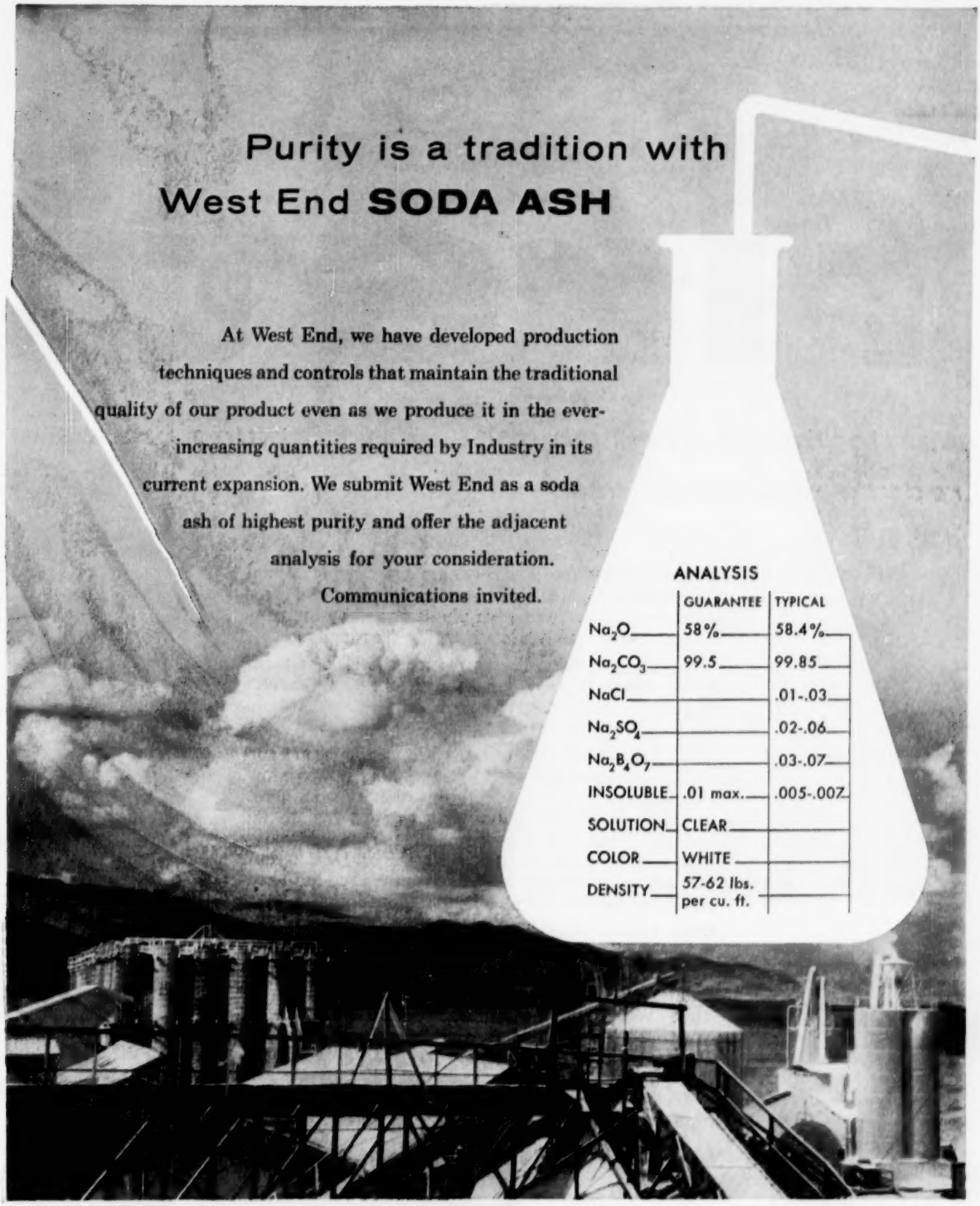
RUGGED Rockwell-Nordstrom valves *stay* trouble-free on pump and compressor lines. Why? Their firmly seated, lubricated plug prevents seat failures that are common to ordinary valves on high pressure or pulsating flow. And even on hard to handle services, shut-off is always positive because a tough film of lubricant forms an instantly replaceable, double seal against leakage.

Rockwell-Nordstrom is the original and world's most complete line of lubricated plug valves and lubricated plug valve accessories. They cost no more to buy, often less, than ordinary valves and they'll save money, give better performance everywhere you use them. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off



WEST END

West End Chemical Company

DIVISION OF STAUFFER CHEMICAL COMPANY

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

world's



first!

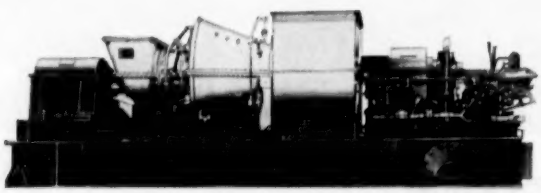
Westinghouse gas turbines in cat cracking process—reduce shutdown risk

WESTINGHOUSE GAS TURBINES are now driving air and gas compressors in a large cat cracking plant and three more are on the way to other plants owned by the same company. Another *World's First* for Westinghouse.

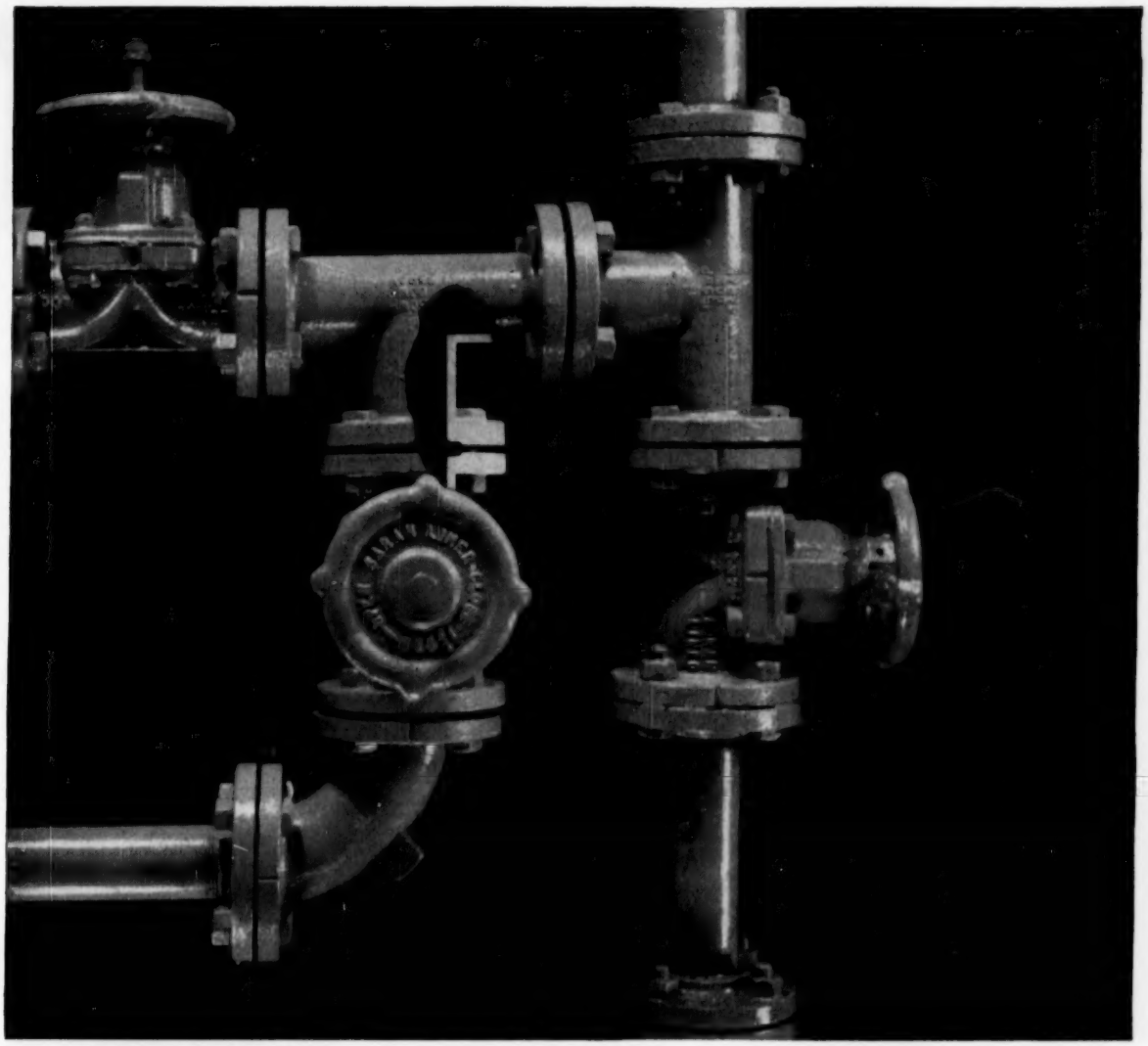
These gas turbine drives reduce the risk of shutdowns; using refinery gas as fuel, operation doesn't depend on other sources of fuel or on steam-generating equipment.

In addition to reliability, the Westinghouse gas turbine offers economy. Capital cost per horsepower is low, and since it's powered directly by refinery gas, there's no steam-generating equipment to buy, install and maintain. Operator payrolls? A few men can easily supervise the semiautomatic gas turbines. Installation? The self-supporting base eliminates the need for a bedplate and the unit may be installed outdoors.

Other Process Applications—Because the gas turbine furnishes shaft power, compressed air and hot gas up to 1000° F, it is used to streamline many processes. Ask today for a set of suggested process sketches. Contact your Westinghouse representative or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50699



YOU CAN BE SURE...IF IT'S Westinghouse



Whatever the piping arrangement, liquid never touches metal in saran lined pipe, fittings or valves.

You can see why saran lined pipe cuts costly downtime

It's a rigid steel pipe lined with durable saran that corrosive liquids won't bother

Now you can pipe commonly used acids, alkalies and other corrosive liquids without worrying about corrosion. With saran lined pipe, the liquid never touches metal – in the pipe, valves or fittings. Corrosion can't get a start–downtime troubles are eliminated.

Because it is two pipes in one, steel swaged onto saran, it has high strength. In fact, saran lined pipe will withstand working pressures up to 300 psi. Saran lined valves and fittings are available for 150-psi and 300-psi working pressures.

You'll get other advantages when you use saran lined pipe. It's easy to fabricate and easy to install. Conventional pipe fitters' tools can be used for cutting and threading. And you can hang it as you would ordinary steel pipe.

If your operation can profit from long-lasting, corrosion-free piping, investigate saran lined pipe today. THE DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY
DEPT. SP159A-1
2415 BURDETTE AVENUE
FERNDALE 20, MICHIGAN

Please send me information on saran lined pipe, fittings and valves.

Name_____ Title_____ Company_____

Address_____ City_____ State_____

YOU CAN DEPEND ON DOW

for

- **Heating or Cooling Fluids**
- **Condensing Gases**
- **Evaporating Liquids**
- **Dissipating Waste Heat**
  and other chemical process heat transfer operations



Marlo

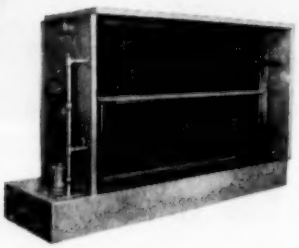
STAINLESS STEEL EQUIPMENT

Custom Built to Your Specifications



Cooling and Heating Coils

Coil Type Spray Dehumidifiers



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New brochure on Marlo stainless steel equipment. Write for your copy today.

Cooling Towers and Evaporative Condensers



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SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

A new line of Standard Oil greases

RYKON

GREASE

Major breakthrough in grease technology results in development of new thickening agent. New grease has greater high temperature stability, superior multi-purpose qualities, improved lubricating properties.

Standard Oil instituted a grease research and development project several years ago. The result of this work is the line of RYKON Greases, which contain a unique new non-soap, organic thickening agent.

RYKON Greases surpass in stability and performance the best greases made up to this time. They bring to industry new opportunities for improved machine performance. They greatly reduce the maintenance and grease handling problems encountered in industry.

RYKON Grease properties

RYKON Greases are smooth, buttery-textured greases, made from the finest quality, solvent-extracted oil. Their thickening agent is a Standard Oil exclusive. RYKON Greases have these high-quality characteristics:

High temperature stability—Better heat stability than any other petroleum oil grease. ASTM dropping point of 480°F. Maintain consistency in service at high temperatures.

Mechanically stable—Maintain consistency even under severe mechanical working in service.

Chemically stable—Inhibit oxidation. Oil and thickening agent in combination possess extremely good chemical stability.

Wide temperature range—Lubricate at high and low temperatures. Extended range of application thus obtained makes RYKON Greases truly multi-purpose.

Water resistance—Do not lose consistency in presence of water. Highly resistant to water washout.

Oil separation—Minimum bleeding of oil in service and storage.

Anti-rusting—Exceptional natural rust preventive characteristics.

With RYKON Greases, lubrication can become simple, foolproof and less expensive—much less expensive, perhaps, than a single shut down caused by equipment failure due to the use of the wrong type of grease or the use of an "economy" grease lubricant.

RYKON Greases come in four Regular and three Heavy-Duty grades. Thus there is a RYKON Grease to take care of every grease lubrication job. Using RYKON Greases plant-wide can reduce your grease storage requirements, simplify lubrication maintenance training, cut down record keeping, save on dispensing equipment and reduce investment in grease inventories.

Get more facts about RYKON Greases. Call your nearby Standard Oil industrial lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Check Chart Of RYKON Greases

Regular Line	Grade Consistency
RYKON Grease No. 0	0
RYKON Grease No. 1	1
RYKON Grease No. 2	2
RYKON Grease No. 3	3
Heavy Duty Line	
RYKON Grease No. 0 E. P.	0
RYKON Grease No. 1 E. P.	1
RYKON Grease No. 2 E. P.	2

STANDARD

STANDARD OIL COMPANY (Indiana)



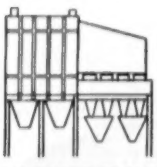
Pay dirt!
...year after year!



BUELL CYCLONE



"SF" ELECTRIC PRECIPITATOR



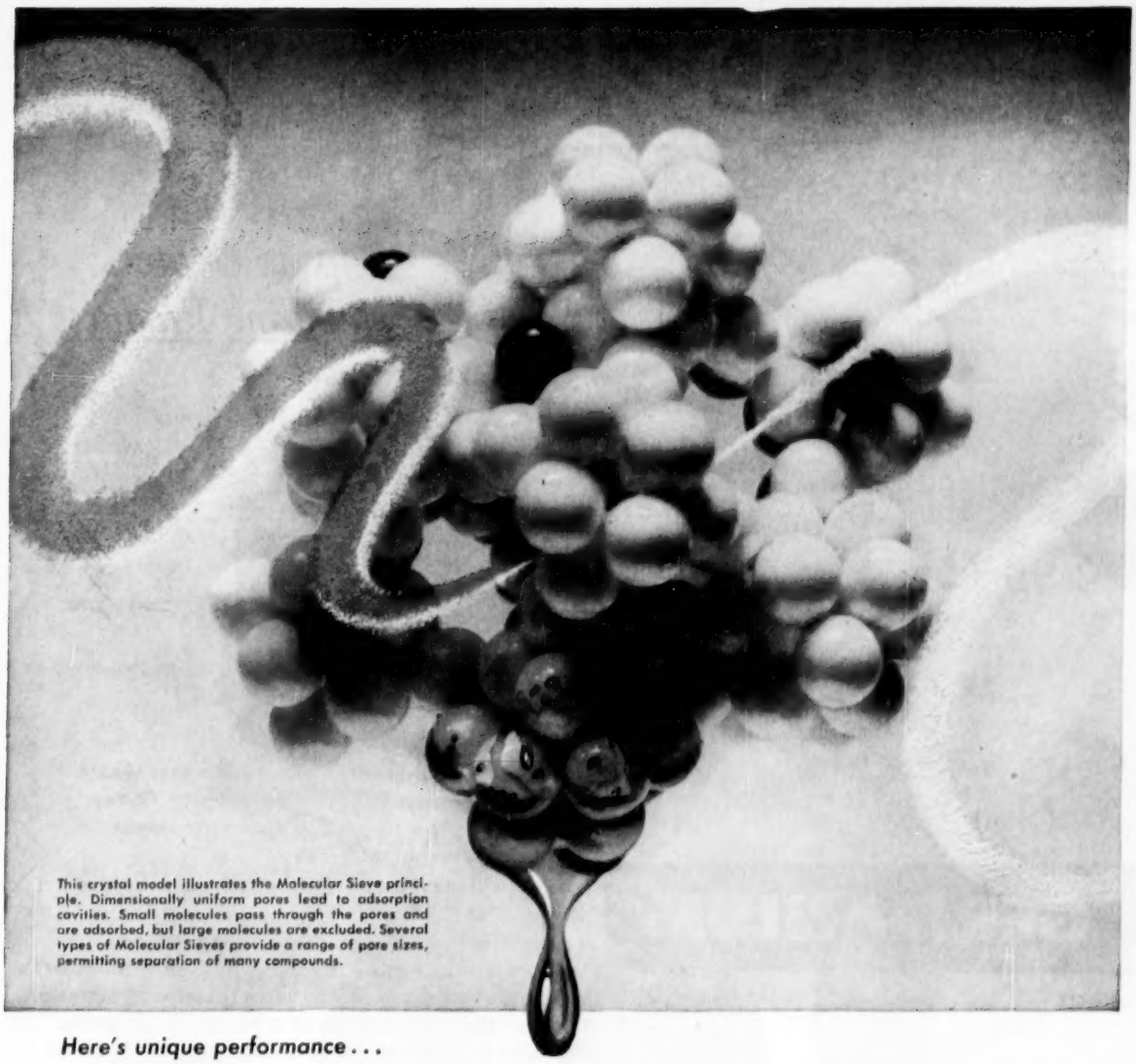
PRECIPITATOR-CYCLONE COMBINATION

Buell Cyclone collectors pay off two ways: extra efficiency from the start . . . and extra years of operation, with little if any maintenance. Unique features like Buell's exclusive Shave-off deliver an extra percentage of dust collection efficiency: in nearly all cases, Buell installations pay for themselves in just a few years. And heavy plate construction, scientific proportioning, side entry of dust-laden gases are reasons why they keep on earning for many, many years. For specific details, write for "The Collection and Recovery of Industrial Dusts". Just write Dept. 12J, Buell Engineering Company, Inc., 70 Pine Street, New York 5, New York.



buell®

Experts at delivering Extra Efficiency in **DUST COLLECTION SYSTEMS**



This crystal model illustrates the Molecular Sieve principle. Dimensionally uniform pores lead to adsorption cavities. Small molecules pass through the pores and are adsorbed, but large molecules are excluded. Several types of Molecular Sieves provide a range of pore sizes, permitting separation of many compounds.

Here's unique performance . . .

Molecular Sieves for Purification and Recovery!

. . . selective removal of contaminants, at temperatures up to 300°F!

. . . selective recovery of valuable stock without regard to relative boiling points!

Molecular Sieves, a new class of adsorbents developed by Linde Company, offer selective separation of gas or liquid mixtures in three ways . . . difference in molecule size . . . or polarity . . . or carbon bond saturation. And, co-adsorption can be utilized to remove several impurities simultaneously.

Typical uses? Removal of catalyst poisons from olefins . . . or extraction of olefins from refinery streams and top gases . . . or simultaneous dehydration and sweetening of natural gas . . . and many, many others.

LINDE Molecular Sieves offer new performance advantages . . . for many production uses. You may be able to lower costs, simplify processes, improve a product with this unique adsorbent. Find out more by writing for data describing Molecular Sieve properties and performance characteristics, Dept. CG-10. Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y.

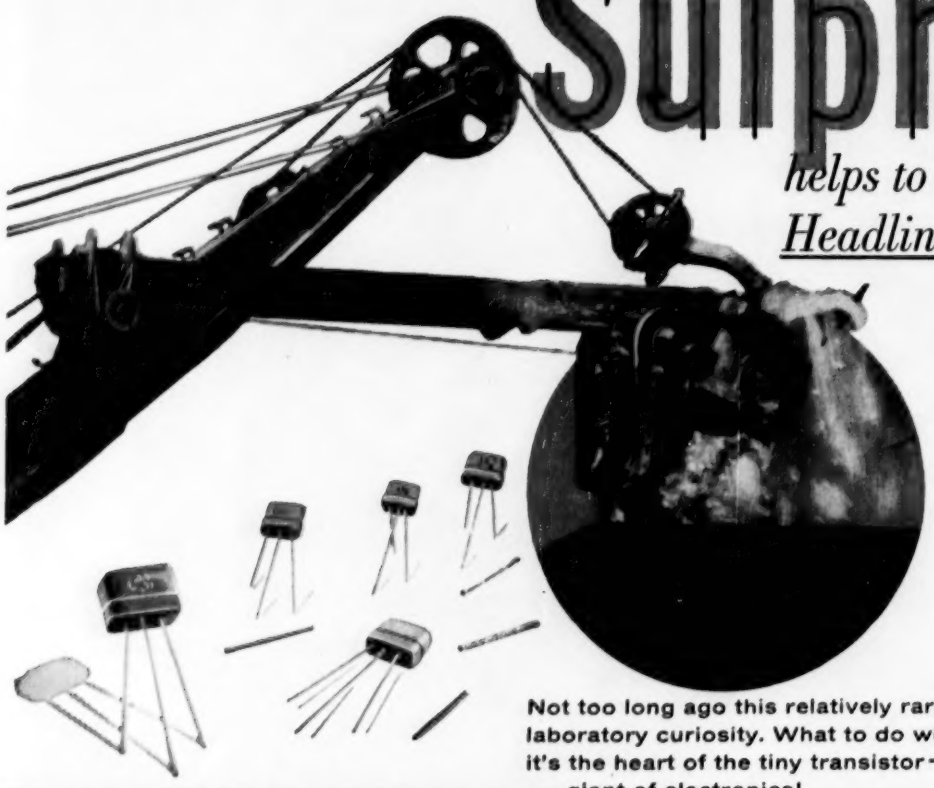
The terms "Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation

Linde TRADE MARK MOLECULAR SIEVES

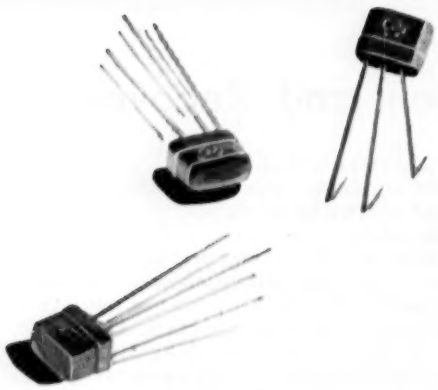
UNION CARBIDE

Sulphur

helps to create
Headline Products



GERMANIUM



Not too long ago this relatively rare metal was a laboratory curiosity. What to do with it? Today, it's the heart of the tiny transistor—the latest giant of electronics!

What's the connection between Sulphur and Germanium?

There are two, in fact. One is man-made, involving the routine leaching of Germanium ores with Sulphuric Acid prior to tetrachloride distillation. The other takes advantage of a peculiar property of the natural mineral, Germanium Sulphide. This mineral can be volatilized and then sublimed, providing an effective method of separating the Germanium from gangue material. The process is called "Concentration of Germanium by Sulphide Sublimation".

Again Sulphur, through its major derivative, Sulphuric Acid, and a natural sulphide play an important role in our ever-expanding economy. It is difficult to find many items in the broad chemical-metallurgical field that do not somewhere along the production line make use of Sulphur or a derivative.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

ENGINEERS...

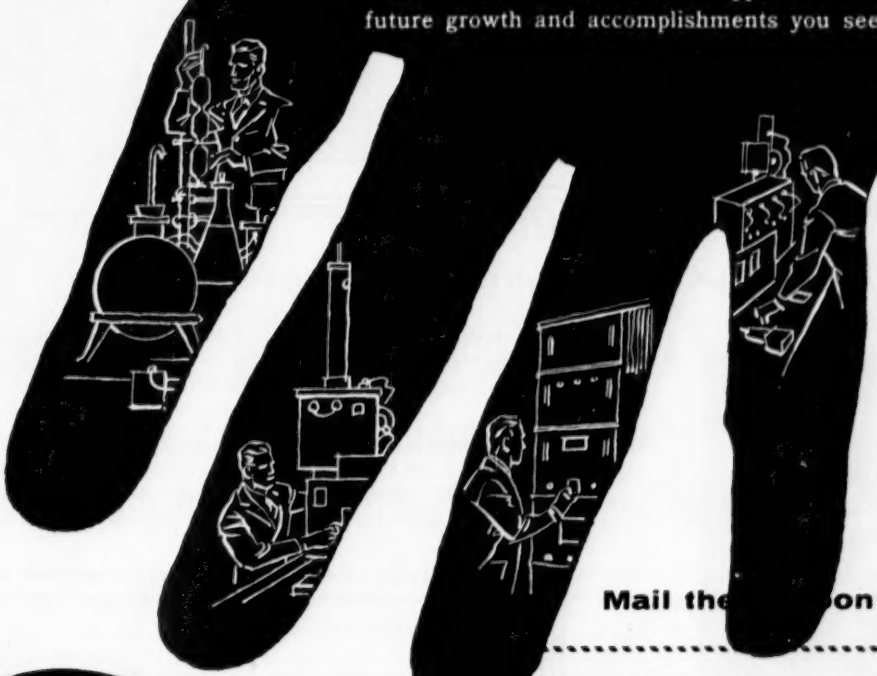
Your future is in your hands!

In your hands lie the answers to where you will be, what you will be doing, how fully you have the opportunity to progress.

For a great future, you owe it to yourself and to your family to investigate The Chemstrand Corporation.

Already a leader in the vital, fast-growing field of chemical-textile fibers, now in its 6th expansion in five years, the greatest growth for Chemstrand and its people still lies ahead. There is still time to get in on the ground floor now.

Get all the facts. We have the opportunities for future growth and accomplishments you seek.



Mail the ...on today!

...ICAL PERSONNEL MANAGER, Dept. Che 10-57
The Chemstrand Corporation, Decatur, Alabama

Gentlemen:

It is my understanding that you need for immediate employment graduate engineers in various fields, particularly chemical, mechanical, industrial, textile and instrument engineering.

I am a graduate _____ engineer.

Please send me information concerning the ground floor opportunities at Chemstrand.

NAME _____

STREET _____

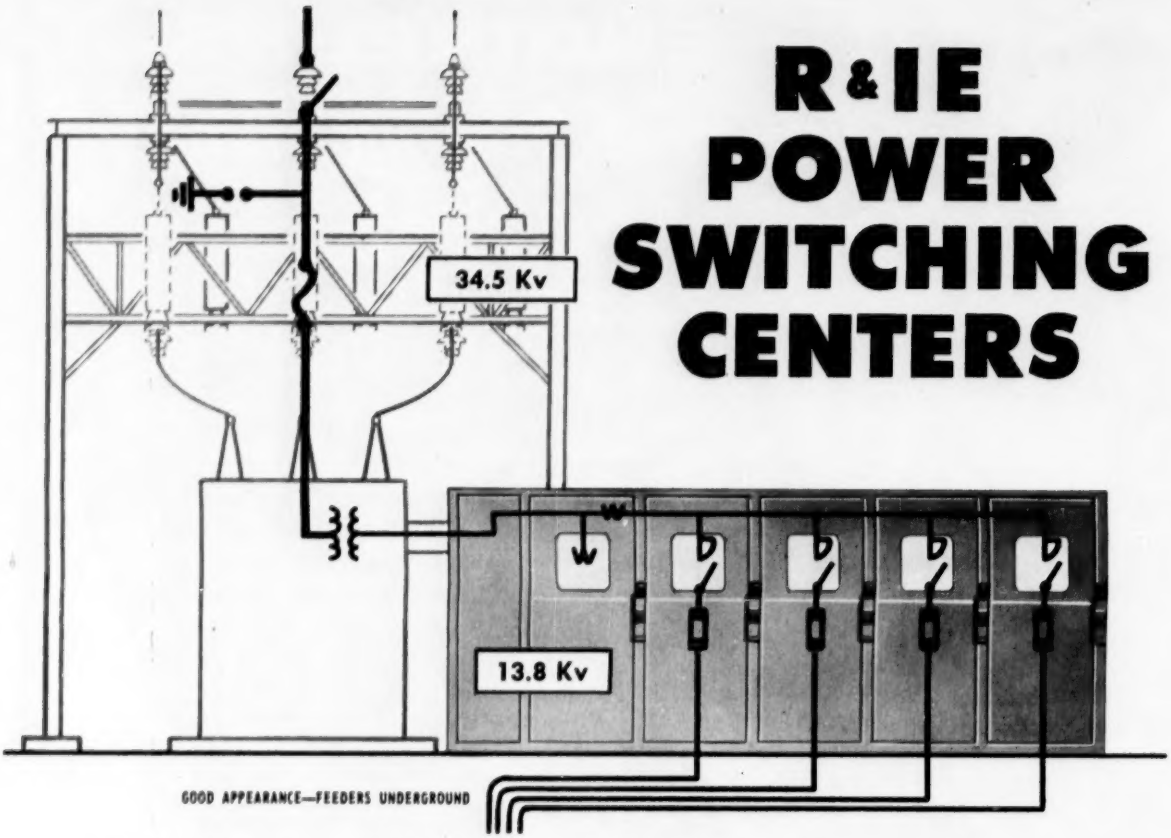
CITY _____ ZONE ____ STATE _____

CHEMSTRAND

THE CHEMSTRAND CORPORATION, DECATUR, ALABAMA

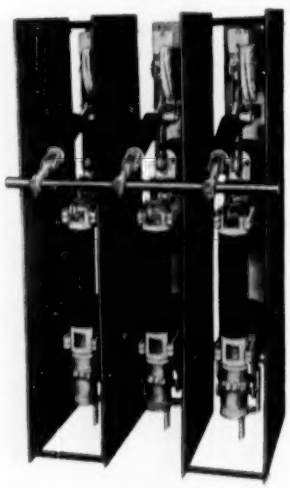
TOMORROW'S BIG DECISIONS WILL BE MADE **by the men who act today...**

R&IE POWER SWITCHING CENTERS



GOOD APPEARANCE—FEEDERS UNDERGROUND

Cost Less *Save Space* *Easier to maintain*



FUSED HPL-C INTERRUPTER SWITCHES

Ratings up to 14.4 Kv (110 BIL)
600 Amperes—(40,000 amps. momentary)
1200 Amperes—(60,000 amps. momentary)

HIGH VOLTAGE PSC CUBICLES, standard design—offer three-way economy for primary switching when space is limited, cost is a factor and where feeders are underground.

CONSERVE SPACE—Less area required than with open structure. Standard PSC cubicles mean space requirements can be accurately determined. Add a cubicle any time—up to 1200 amp. total load.

SAVE MONEY—R&IE fused interrupter switches, in PSC cubicles, provide a high degree of protection. High interrupting capacity at moderate cost.

REDUCE MAINTENANCE PROBLEMS—Easily operated; window front inspection; equipment accessible; universally-known power fuses. Can be handled by any factory or building maintenance crew.

Add safety with optional TOG-L SNAP operating mechanisms.

Ask your I-T-E Representative to show you the many economies of PSC cubicles.

R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

PSC - 4

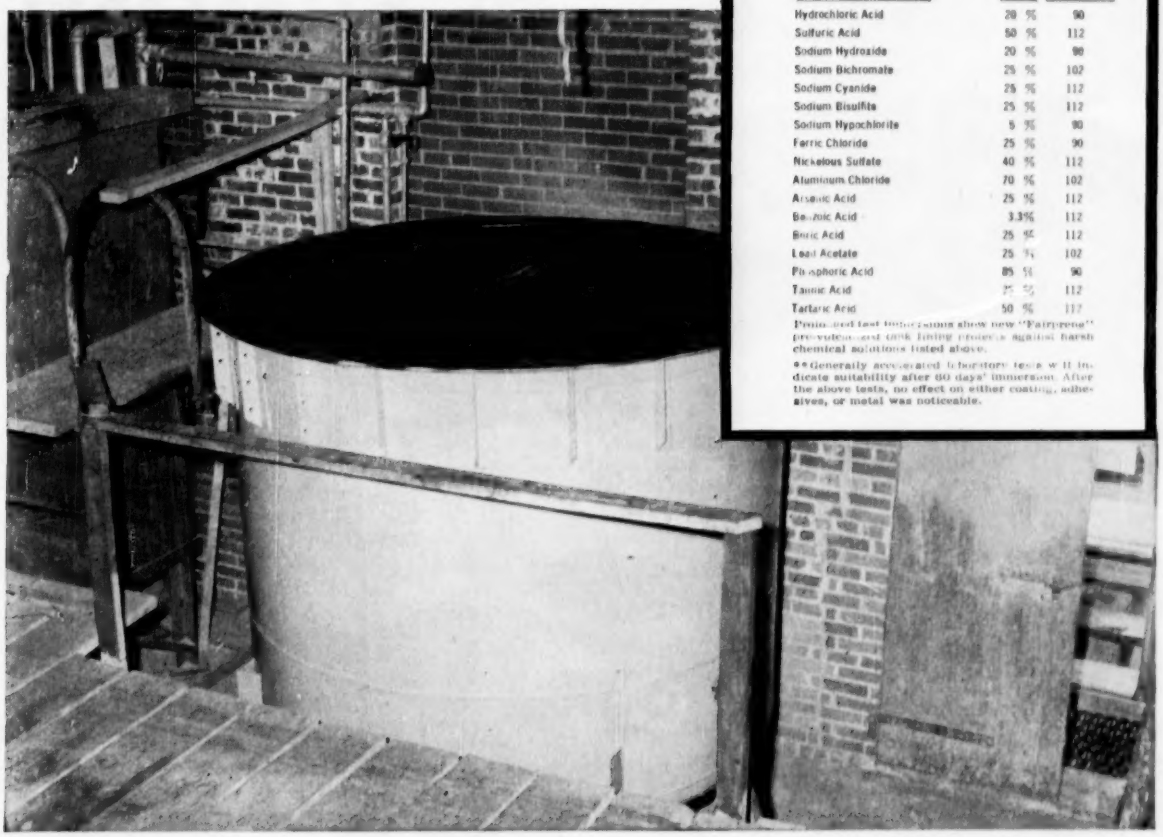
NEW—protective lining sheet that needs no vulcanizing

IMMERSION TEST TABLE
Steel Panels Covered with "Fairprene" in Corrosive Solutions at 212°F.

Immersion Medium	Conc.	No. Days**
Hydrochloric Acid	20 %	90
Sulfuric Acid	50 %	112
Sodium Hydroxide	20 %	90
Sodium Bichromate	25 %	102
Sodium Cyanide	25 %	112
Sodium Bisulfite	25 %	112
Sodium Hypochlorite	5 %	90
Ferric Chloride	25 %	90
Nickelous Sulfate	40 %	112
Aluminum Chloride	70 %	102
Arsenic Acid	25 %	112
Benzoic Acid	3.3%	112
Boric Acid	25 %	112
Lead Acetate	25 %	102
Phosphoric Acid	85 %	90
Tannic Acid	25 %	112
Tartaric Acid	50 %	112

Printed test instructions show new "Fairprene" pre-vulcanized cork lining resists against harsh chemical solutions listed above.

**Generally accepted laboratory tests will indicate suitability after 60 days' immersion. After the above tests, no effect on either coating, adhesives, or metal was noticeable.



Economical new pre-cured Fairprene® lining material provides superior protection against hot corrosive solutions

Because Du Pont's new "Fairprene"* protective lining material is pre-vulcanized, Livingstone Coating Corp., custom applicators, were able to line the above tank on location. "Fairprene" protects against chemical action that would corrode the tank and contaminate the solution it contains at North Carolina Finishing Co., Salisbury, N. C.

"Fairprene" sheet stock is made specifically for protective lining which offers outstanding resistance to harsh chemicals, ozone, oxidation, aging and abrasion. "Fairprene" shows superior heat resistance—can be used at temperatures as high as 200°F. Lining costs are reduced because "Fairprene" is pre-cured. It needs no special storage or shipping conditions, does not deteriorate with age and can be applied on location to minimize equipment downtime. Du Pont "Fairprene" lining is offered in a complete system of materials including sheet (rolls 50" wide and 1/8" thick), tape, cements, activators and putty.

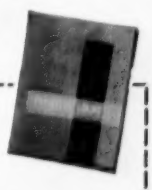
Find out more about the low-cost protection you can give your equipment with "Fairprene" protective lining material. Mail the coupon.

DU PONT INDUSTRIAL COATED FABRICS SHEET STOCKS • CEMENTS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

*"Fairprene" is Du Pont's registered trademark for its coated fabrics, sheet stocks and cements.



E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Division, CE-710, Wilmington 98, Del.
Please send me your booklet on "Fairprene" pre-vulcanized protective lining.

*Name*_____ *Position*_____
*Company*_____
*Address*_____
*City*_____ *State*_____

for corrosion protection get CLAYMONT



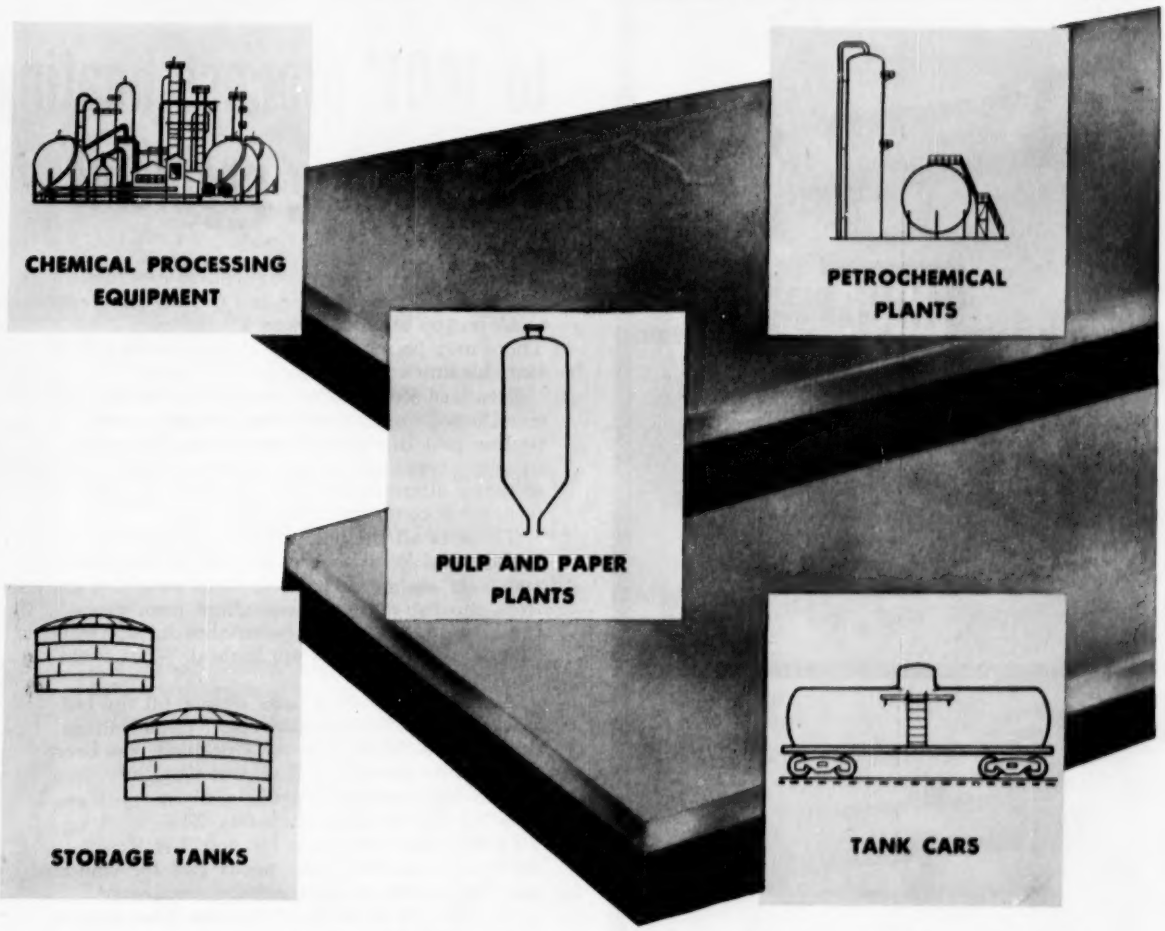
PROTECTION of Stainless Steel *here*—where it's needed.

STRENGTH and **ECONOMY** of Carbon Steel *here* —where corrosion isn't a factor.

- Stainless and backing plates inseparably bonded
- Thickness of stainless steel as specified—from 5% to 50% of total plate thickness
- Wide range of stainless and carbon steel specifications available

that costs less...
Stainless-Clad steel

USES FOR STAINLESS-CLAD



For these . . . and many other applications where *low-cost* protection against corrosion or product contamination is a vital requirement . . . manufacturers are specifying Claymont Stainless-Clad Plates, Heads and Fittings. Why not bring *your* problem to us? Just contact our nearest sales office today.

5058

CF&I

Claymont Steel Products

Products of Wickwire Spencer Steel Division · The Colorado Fuel and Iron Corporation
P. O. Box 1951 – Wilmington, Delaware

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Lincoln • Los Angeles New Orleans • New York • Oakland • Odessa • Oklahoma City • Philadelphia • Phoenix • Portland (Ore.) • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane Tulsa • Wichita—**CF&I OFFICES IN CANADA:** Montreal • Toronto—**CANADIAN REPRESENTATIVES AT:** Calgary • Edmonton • Vancouver • Winnipeg

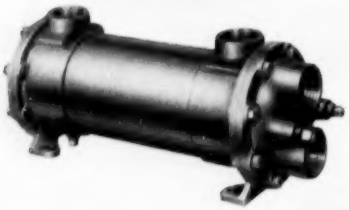
OTHER CLAYMONT PRODUCTS

Alloy Steel Plates • Large Diameter Welded Steel Pipe • Manhole Fittings and Covers • Flanged and Dished Heads
High Strength Low Alloy Steel Plates • Fabricated Steel Parts • CF&I Lectro-Clad Nickel Plated Steel Plates





ROSS







READY ANSWER

to 1001* process heating and cooling problems

* No one has made a recent check to determine just how many process heating and cooling assignments are taken on by standard Ross Exchangers. There may be more than a 1001, or even a few less. But this much *is* known . . .

Standard Ross Exchangers are engineered and constructed to cope with the *unusual* as well as the routine jobs in chemical processing. There are so many types and sizes, so many kinds of materials, so many alternate features available . . . it's hard to name a condition they don't meet.

Think of all the delays and costs that are spared in this way! With several designs pre-engineered and fully standardized in a large range of graduated sizes, units are readily assembled from mass produced parts and sub-assemblies in relatively no time at all . . . for each application. What could be simpler?

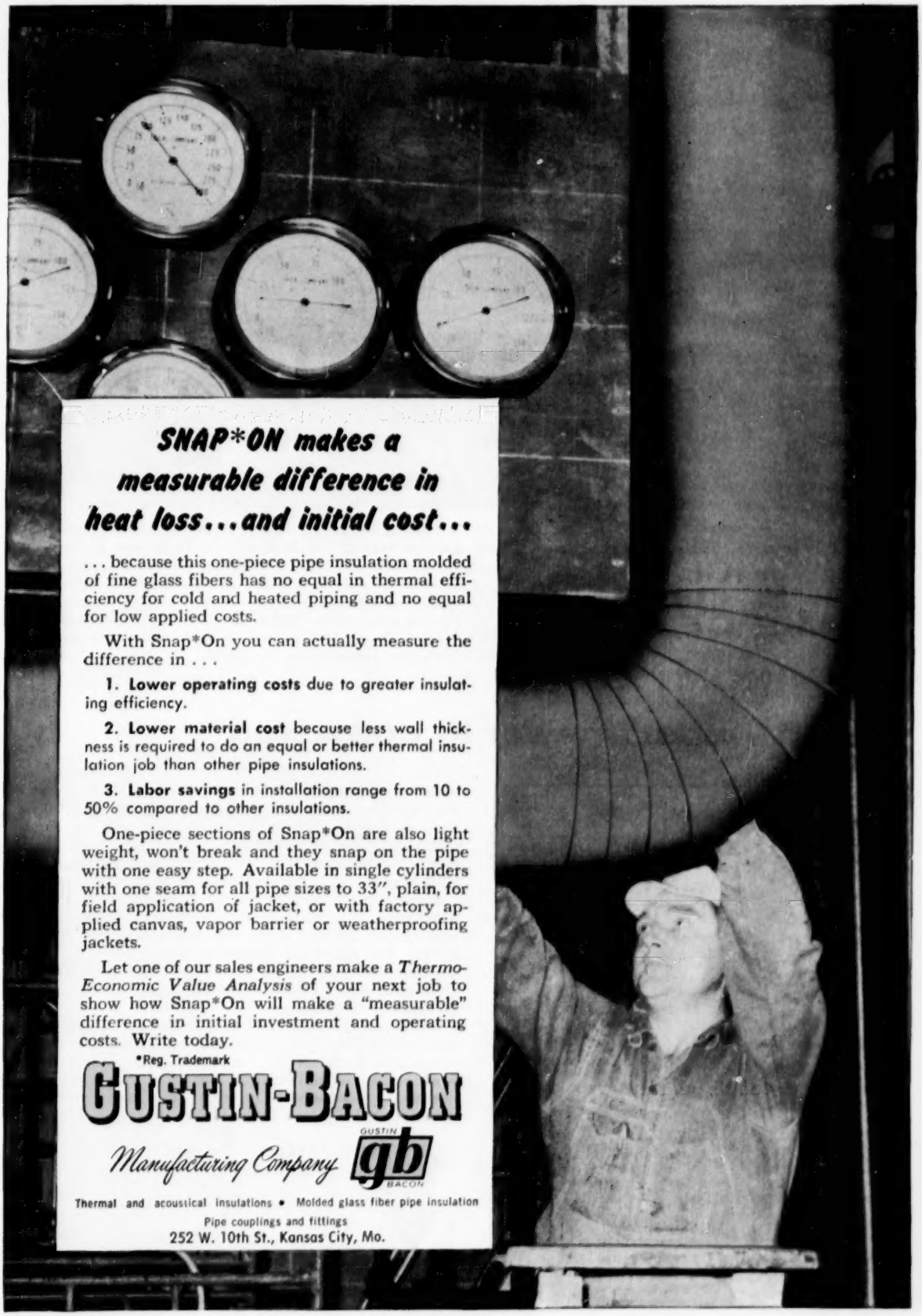
And when standard units cannot fill the bill *precisely for all conditions,* slight modifications often do the trick. Many a process problem has been successfully solved by Ross this way, too.

But why concern yourself with the problem at all? That's a job for Ross engineers. They're doing it for others, and can do it for you. Let Ross determine whether *your* needs call for standard, modified standard, or specially engineered units. Yes, let Ross do it, because Ross designs and builds all three!

Write Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS HEAT EXCHANGER

Division of AMERICAN-Standard



SNAP*ON makes a measurable difference in heat loss...and initial cost...

... because this one-piece pipe insulation molded of fine glass fibers has no equal in thermal efficiency for cold and heated piping and no equal for low applied costs.

With Snap*On you can actually measure the difference in ...

1. **Lower operating costs** due to greater insulating efficiency.

2. **Lower material cost** because less wall thickness is required to do an equal or better thermal insulation job than other pipe insulations.

3. **Labor savings** in installation range from 10 to 50% compared to other insulations.

One-piece sections of Snap*On are also light weight, won't break and they snap on the pipe with one easy step. Available in single cylinders with one seam for all pipe sizes to 33", plain, for field application of jacket, or with factory applied canvas, vapor barrier or weatherproofing jackets.

Let one of our sales engineers make a *Thermo-Economic Value Analysis* of your next job to show how Snap*On will make a "measurable" difference in initial investment and operating costs. Write today.

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GUSTIN-BACON

Manufacturing Company GUSTIN gb BACON

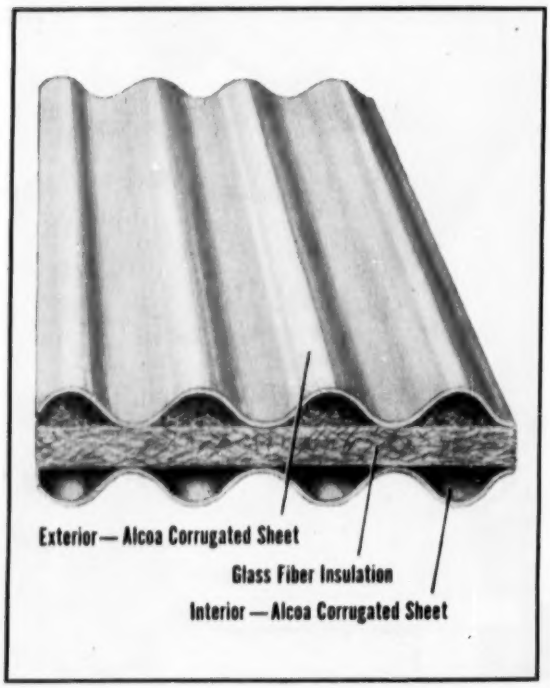
Thermal and acoustical insulations • Molded glass fiber pipe insulation
Pipe coverings and fittings
252 W. 10th St., Kansas City, Mo.



The new Schlumberger Well Surveying Corporation building for Johnson Testers, Inc. in Sugarland, Texas puts aluminum to the acid test. It's located in the hot, humid, salt-laden atmosphere of the Gulf of Mexico. Aluminum sandwich walls assure lasting protection against corrosion. Their reflectivity and insulating effect lighten the air-conditioning load. Engineers and builders: The Austin Company, Houston, Texas. Alcoa Approved Applicator: Jamar-Olmen Construction Co., Houston, Texas.

SANDWICH WALLS OF ALCOA ALUMINUM . . .

your low-cost answer to corrosion



Nothing eats into profits more relentlessly than corrosion. But sandwich walls of Alcoa® Aluminum are an effective, low-cost answer to this problem. They're immune to corrosion, whether from acid or alkaline fumes, salt atmospheres, humidity or chemical-laden industrial atmospheres. They stay good-looking longer and never lose their strength.

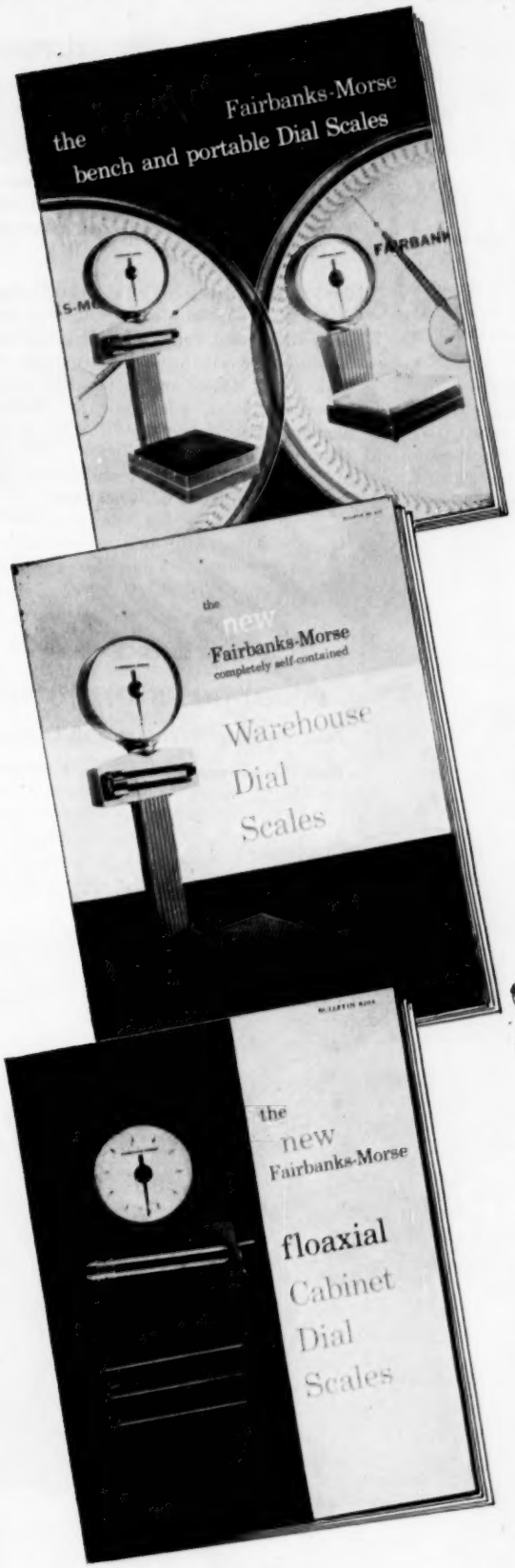
Surprisingly, you pay less for sandwich walls of Alcoa Aluminum. It is, in fact, the lowest cost, insulated metal wall system known! Aluminum's lighter weight permits lighter, less expensive foundations and framing, speeds erection and painting is eliminated once and for all—aluminum never needs it—saves many, many dollars throughout the years.

Walls can be moved and re-used during expansion and remodeling. What's more, aluminum's corrosion resistance serves just as effectively on windows, gratings, pipes, ductwork and other mill fixtures. Get all the facts from your nearest Alcoa sales office, or write Aluminum Company of America, 856-K Alcoa Building, Pittsburgh 19, Pa.

***NEW!* "ALCOA THEATRE"**
Exciting Adventure—Alternate **Monday** Evenings

WE CHOSE ALCOA ALUMINUM
INDUSTRIAL BUILDING PRODUCTS

Your Guide to the Best in Aluminum Value



what's inside the Floaxial?

What makes it better than the great Fairbanks-Morse scales of the past? Maybe you're not curious. Maybe you're satisfied just so long as it weighs ever more precisely, is able to stand even more abuse, and practically does your thinking for you in the process of coming up with the right answer.

But if you're mechanically minded and would be interested in how all this is accomplished, the story of the inner workings is told in the new Floaxial bulletins which are yours for the asking.

The portable and bench models are self-contained . . . portables are easily moved on rubber-tired wheels. Self-contained warehouse scales equipped with either pillar or cabinet type Floaxial dial are built to set on floor or installed with platform flush with floor. Cabinet dials have the exclusive F-M direct-reading feature that enables the weighman to read the dial right at the point of the indicator without mental calculation—regardless of the number of drop weights applied. Cabinet dials are available for use with many types of lever systems. Fairbanks, Morse & Co., Chicago 5, Illinois.

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a name worth remembering when you want the BEST

SCALES · PUMPS · DIESEL LOCOMOTIVES AND ENGINES · ELECTRICAL MACHINERY
RAIL CARS · HOME WATER SERVICE EQUIPMENT · MOWERS · MAGNETOS

Fairbanks, Morse & Co.
600 South Michigan Ave.
Chicago 5, Illinois

Dept. CE-16

Please send me the Floaxial Scale Bulletin specified below.

- ☐ Bench and Portable Dial
- ☐ Warehouse Dial
- ☐ Cabinet Dial

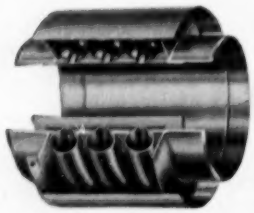
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NEW ZALLEA HyPTor* TOROIDAL EXPANSION JOINT



HyPTor corrugations have a circular or toroidal cross section which provides a lower operating stress at any given pressure than any other corrugation shape.

For unequalled endurance at pressure and temperature extremes

This unique toroidal expansion joint with thin-walled bellows is setting new performance and durability records in high pressure, high temperature service. It was developed to meet the severest operating conditions without sacrificing long life.

Minimum stress at high pressures is one advantage of the Zallea HyPTor. This is due to the thin-walled bellows and toroidal corrugations. Thin walls develop lowest flexing stress. The toroidal cross section assures lower operating stress at any pressure.

Superior performance at high temperatures. The toroidal corrugation of the HyPTor makes it suitable for use at high temperatures. Also, the HyPTor is hydraulically formed and free from circumferential welds which would act as stress raisers.

Longer life on the job. The ability of the HyPTor to absorb punishment without ill effects has been proved in service. A number of HyPTor Expansion Joints designed for 700 psi working pressure, were installed in liquid oxygen service in 1948. They are still operating . . . at pressures up to 2300 psi.

Get the complete story of the new Zallea HyPTor Expansion Joints. Our new 72-page Expansion Joint Manual gives full details—plus worthwhile information on basic types, design and installation data, expansion joint selection and recommended specifications. Write on your Company letterhead, for your free copy of Catalog 56, Zallea Brothers, 879 Locust Street, Wilmington 99, Delaware.

*Patented



Zallea
expansion joints

Zallea Brothers, Wilmington 99, Delaware

World's largest manufacturer of expansion joints.

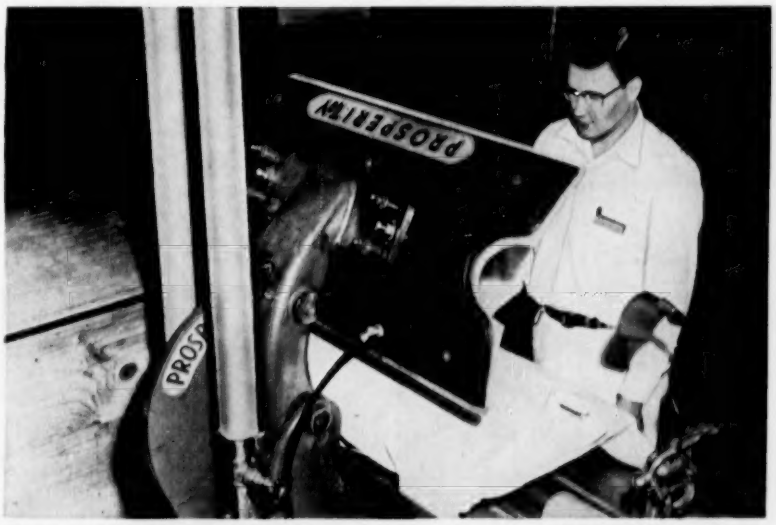
DU PONT

NEWS

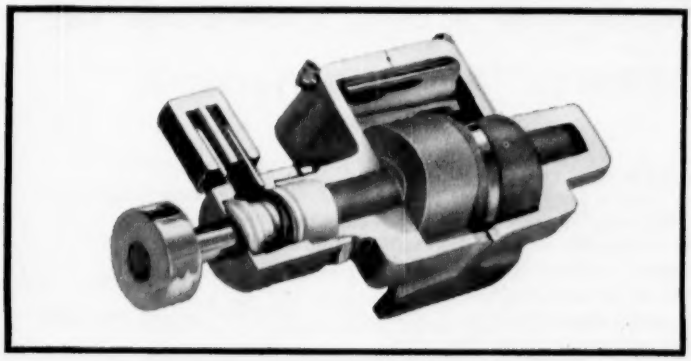
Hose lines of TEFLON® tetrafluoroethylene resins handle live steam, withstand constant flexing without failure

Proof once again that flexible hose lines made with TEFLON 6 are ideal for conveying live steam comes from a large institutional laundry in Michigan. Hose lines made with a TEFLON 6 tetrafluoroethylene resin replaced synthetic rubber hoses which were subject to frequent, dangerous and expensive blow-offs. The new hoses stand up under constant flexing . . . resist cracking despite heat and pressure.

Industrial hoses lined with TEFLON resins, reinforced with a wire overbraid, offer long service life and greatly reduce maintenance. They can be used in continuous processes at 500°F. and at pressures to 3000 psi. Adhesive materials have little tendency to stick to the "waxy" internal surface, and resistance to corrosives is extreme. Mail the coupon for more information on hose, pipe and tubular products of TEFLON resins.



LAUNDRY EQUIPMENT STEAM LINES with inner tubing made of TEFLON 6 resist cracking under heat, pressure and continuous flexing. Shown are steam presses which have been converted to the new hose. (Hoses by Aeroquip Corp., Jackson, Michigan.)



NEW CHEMICAL PUMP has a unique liquid seal and uses TEFLON tetrafluoroethylene resins to achieve extreme inertness to chemicals. Impeller and bearings (pink) are made of glass-reinforced TEFLON 1; fluid retainer ring and adapter (white) are machined from extruded TEFLON 1 or 5; TEFLON 30 is used in fluid dispersion (red) as a hydraulic sealant and lubricant.

A feed cup forces the fluid resin around the pump shaft, achieving a practical, no-clearance fit. TEFLON 30 eliminates surface scoring of shaft and stops passage of pumpage or air in or out of the pump. TEFLON resins make the pump "self-lubricating." (Made by ECO Engineering Company, Newark, New Jersey.)

TEFLON®

is a registered trademark...

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the tetrafluoroethylene resins discussed herein. This registered trademark should not be used as an adjective to describe any product, nor should it be used in whole, or in part, as a trademark for a product of another concern.

SEND FOR INFORMATION

For additional property and application data on Du Pont TEFLON tetrafluoroethylene resins, mail this coupon.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept.
Room 710, Du Pont Building, Wilmington 98, Delaware

Please send me more information on Du Pont TEFLON tetrafluoroethylene resins. I am interested in evaluating TEFLON for_____

Name_____

Company_____ Position_____

Street_____

City_____ State_____

Type of Business_____

for ACCURATE
Moisture Analysis
Completed within
SECONDS...







NMR

ANALYZER

Tests are Consistently Accurate to 0.1%. No Skilled Operator Needed. No Change in Material Under Test.

Where speed is important in moisture determinations, as well as consistently reproducible accuracy, there is simply no equal for the new Schlumberger NMR Analyzer. Processors of foodstuffs, fibrous matter, confections, and other "bulk" materials where many moisture analyses are required, find the NMR instrument pays for itself in short order in personnel savings *alone*—and far greater economy results from the shorter processing and storage times made possible.

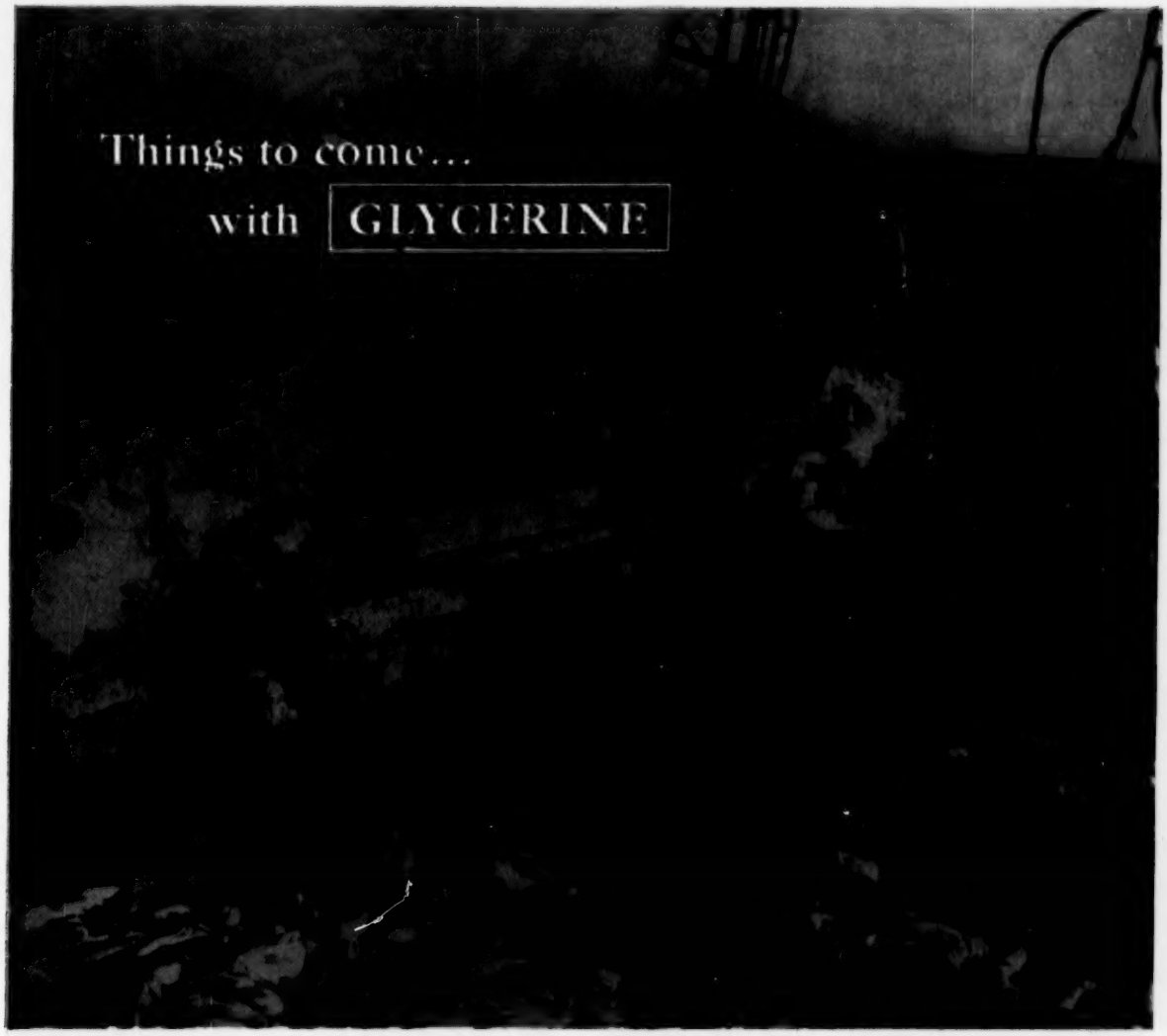
Consult our chemists on the applicability of the Schlumberger Analyzer to your own operations . . . and for news about our Lease-Purchase Plan.

Write Schlumberger Well Surveying Corporation, Room 800 Ridgefield, Connecticut.



SCHLUMBERGER

WELL SURVEYING CORPORATION



"Auto-mersion" freezing may go to sea

Glycerine in immersion freezing processes can provide important advantages for fast automatic freezing. Adapted to commerical fishing vessels, such "automersion" may well enable the fisherman to preserve fish within minutes of the time of catch.

The ideal refrigerant liquid in such a process is one based on Glycerine—with its unique combination of low freezing point and nontoxic properties in solution. The unwrapped products can pass directly through the refrigerant, will emerge separately frozen, will not fuse into a solid mass. Salt or other acceptable additives may give extra preserving power to the freeze solution.

Glycerine has already been applied in solutions for freezing by direct contact, experimentally here —commercially abroad. In other types of food applications its acceptability has long been a matter of record.

Glycerine's usefulness continues to grow. Stable in price, dependable in supply, Glycerine offers processors a unique balance of properties: it is hygroscopic, nontoxic, stable, nonvolatile, with excellent solvent power and agreeable taste. New applications for Glycerine are extending its use in foods, pharmaceuticals, coatings, packaging and many other fields. For a useful 20-page booklet, "Glycerine Properties and Uses", write to:

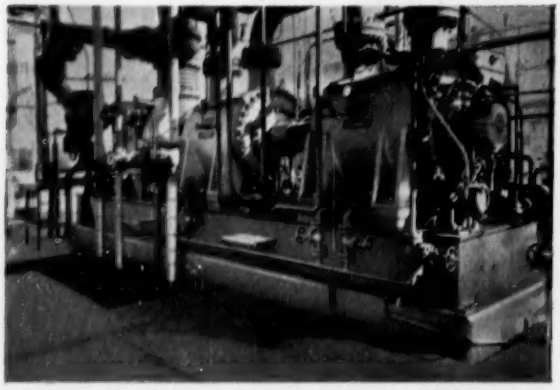
Glycerine Producers' Association

295 Madison Avenue, New York 17, N. Y.

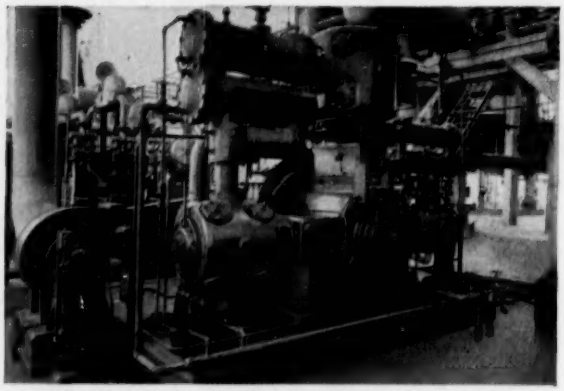
Nothing takes the place of Glycerine

At Amoco's No. 1 Texas City Ultraformer . . .

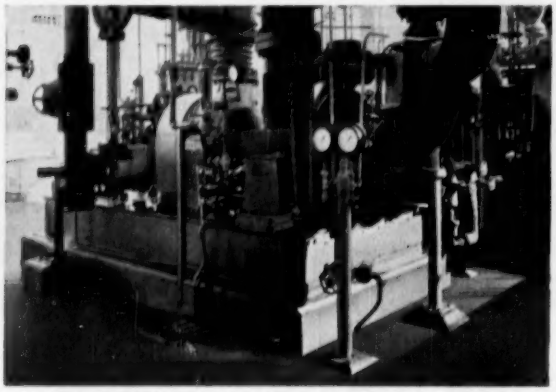
Ingersoll-Rand compressors handle all air and gas requirements



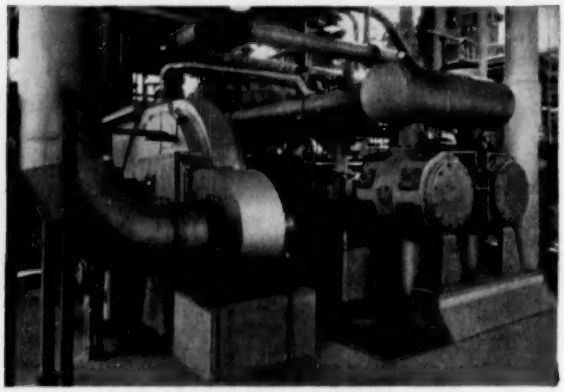
Hydrogen Gas is recycled by these two steam-turbine-driven Ingersoll-Rand vertically split centrifugal compressors arranged in series tandem. Final discharge pressure is 470 psi.



Inert Gas is handled by this TVH electric-motor-driven three-stage reciprocating compressor. Unit is rated at 500 psi.



Hot Gas at 680°F is circulated by this single-stage Ingersoll-Rand centrifugal that handles 3620 cubic feet per minute.



Compressed Air at 275 psi is furnished by this 700-hp Ingersoll-Rand HHE reciprocating compressor.

I-R centrifugal and reciprocating compressors also selected for No. 2 Ultraformer.

WHEN Amoco's No. 1 Texas City Ultraformer went on the line in February 1955, it was served by the Ingersoll-Rand centrifugal and reciprocating compressors shown above. For the No. 2 Ultraformer, scheduled to go into operation later this year, I-R centrifugal and reciprocating compressors were again specified to handle all air and gas requirements.

Repeat orders are the best measure of customer satisfaction . . . convincing proof of the extra dependability and low-maintenance features of every Ingersoll-Rand compressor.

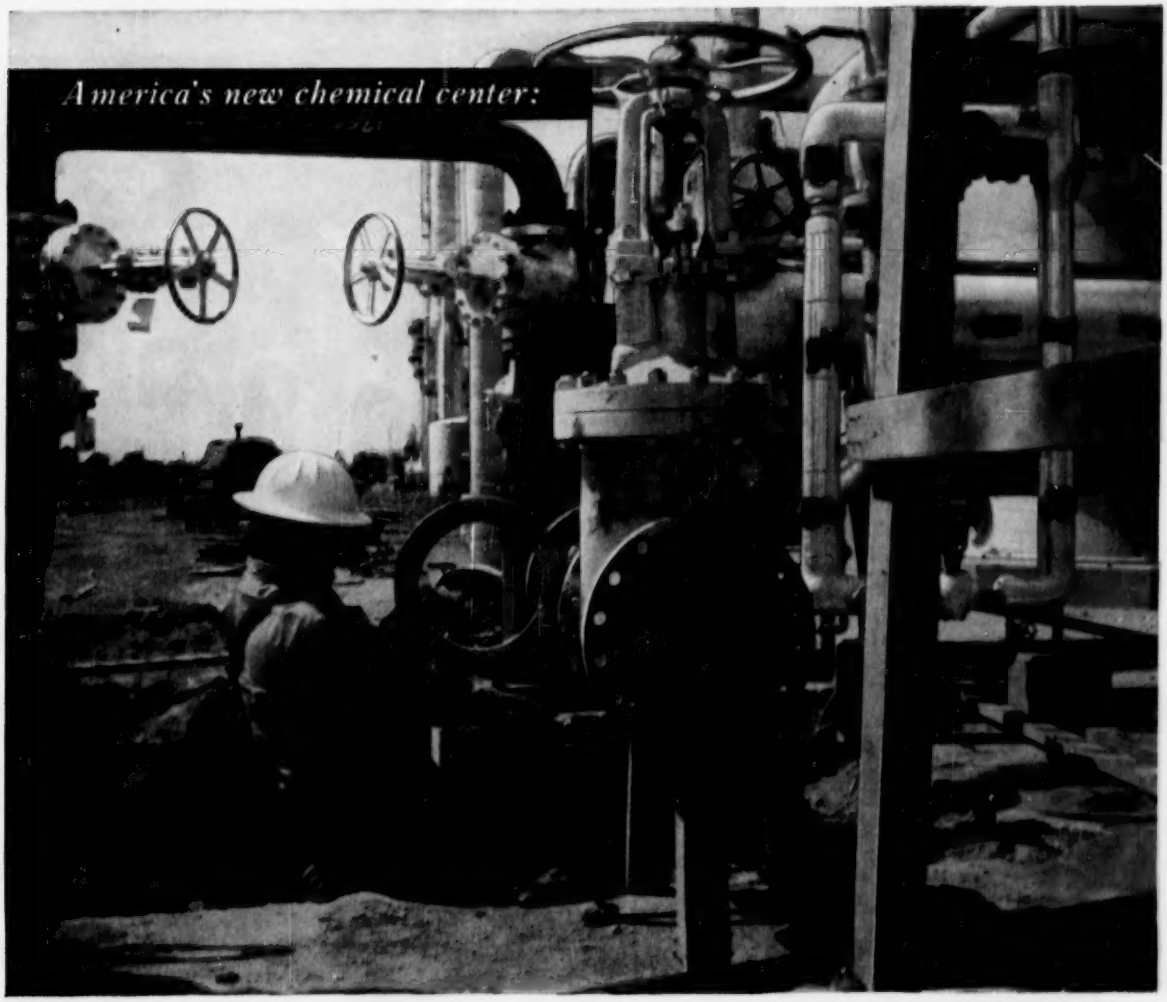
Whether the application calls for a centrifugal or a reciprocating compressor — or a combination of both — the right compressor for the job can be found in Ingersoll-Rand's complete line of standardized units or, if necessary, a compressor can be designed specially for the job. Ask an I-R engineer to tell you more about the "job-proven" advantages of I-R compressors. Ask for your copy of Form 3132-A, Process Compressors.

12-683

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New plant facilities, plus virtually unlimited supplies of natural gas, mean even greater assurance of Petro's ability to supply your long-term bulk requirements of petro-chemicals.

Along with stepped-up production of ethylene, the $10,000,000 expansion of Petro's $75,000,000 plant at Tuscola, Illinois, provides for greatly increased output of polyethylene* New facilities in other sections of the plant will provide not only adequate capacity for meeting anticipated petro-chemical demands, but maximum flexibility for producing other products as needs arise.

Why not look to Tuscola for your present and future needs of bulk petro-chemicals? It's America's newest chemical center—conveniently located in mid-continent to serve a major segment of American industry. Our engineers will be glad to discuss your requirements.

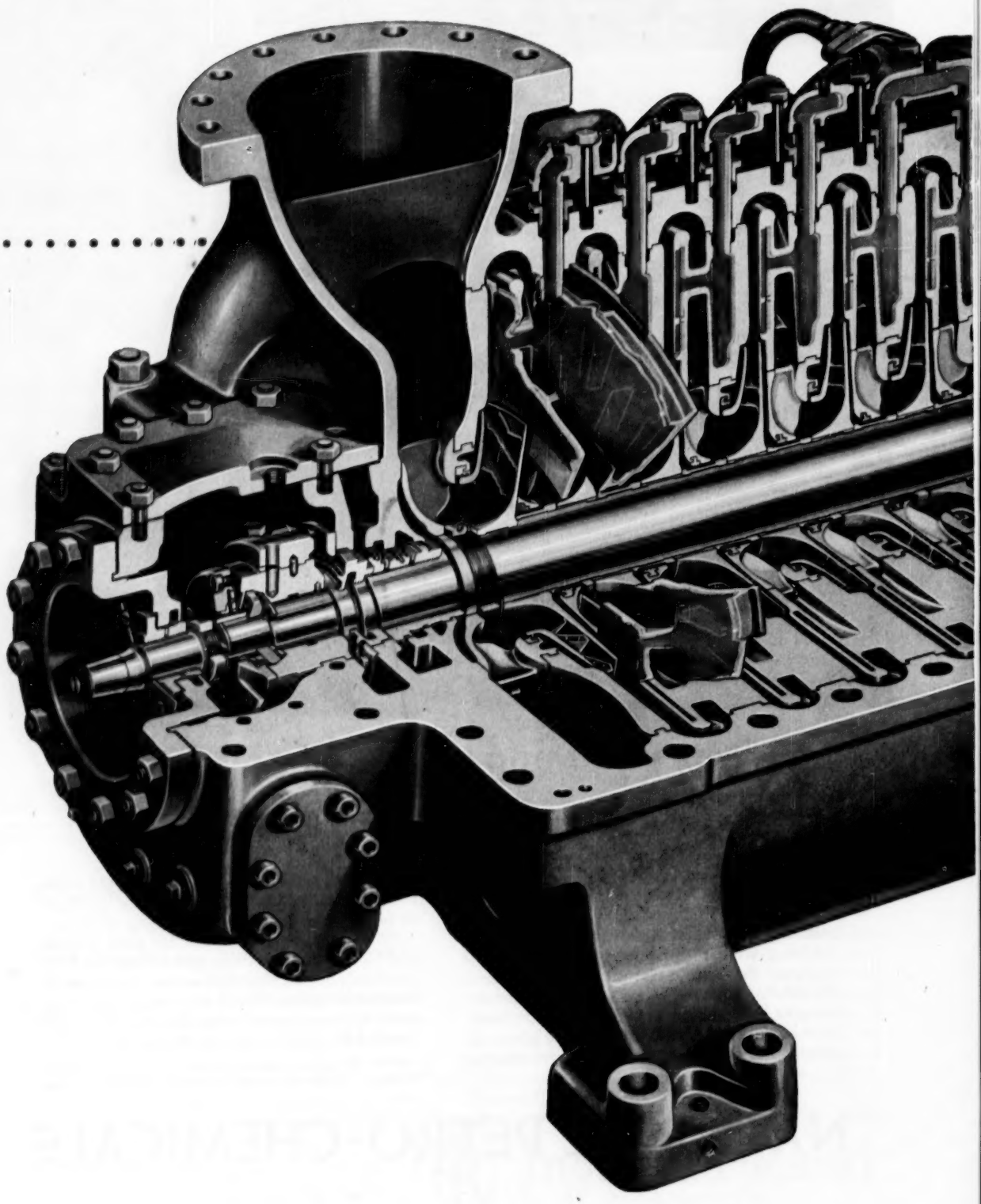
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CORPORATION

A joint enterprise of National Distillers and Chemical Corporation and Panhandle Eastern Pipeline Company

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CLARK

Diaphragm Cooling

- **Minimizes polymer formation**
- **Slashes horsepower requirements**
- **Greater safety handling hazardous gases**
- **Reduces capital investment**

Clark double-wall diaphragm cooling is the simplest, safest, and most effective way to intercool a multi-stage centrifugal compressor. Furthermore, polymer formation is minimized in the compressing of unsaturated hydrocarbon gases by the use of diaphragm cooling. It is a simple, economical method of maintaining gas temperature at the desired level in the capacity range of 1,000-30,000 CFM.

Power savings are an additional benefit of diaphragm cooling. The savings range from 20% on 15 molecular weight vacuum gas compressing applications to 5% for 110 psig. air compressors. Reduced installation and operating costs result.

Minimum capital investment is realized another way. Applications involving high compression ratios such as gas recovery and 120 psig. or less air compressors can be handled in a single case.

Diaphragm cooling also assures maximum safety when compressing oxygen, acetylene, and other difficult gases. Internal surfaces are always cool. Danger from potential hot spots is highly remote.

Clark builds a complete line of multi-stage centrifugal compressors and in many instances a gas turbine to drive them. Your nearest Clark representative has all the facts.

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CLARK

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a series about

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Mr. Albert G. Blank
Sales Manager
Process Industries Sales

No. 8: policy summary

Over the many years of our history, we have endeavored to build a policy of service to supplement the manufacture of Proctor drying equipment.

This policy has been effective as substantiated by a continuing growth in customer confidence—by an ever expanding record of successful installations. In the preceding seven articles, we have tried to describe something of what this policy can mean to you as a customer.

We have reviewed the value of discussing drying problems with Proctor while your product is in research; touched on the importance of our experience in interpreting drying data; described our test facilities and programming; covered the functions of Proctor's sales service and preliminary engineering; outlined our experience and ability to design and build a dryer exactly suited to your needs, and pointed out the follow-through that is vital to continuing customer satisfaction.

As we close this series, we invite you to call upon Proctor so that you may realize the advantages of this policy as applied to your product.

It is only in this way that the full meaning of "Proctor service", "guaranteed performance" and "customer satisfaction" can be understood.

Proctor

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Best source for all resin chemicals!

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Today we continue to set a high standard for the industry!

In color particularly, National® Phthalic Anhydride is excellent. It is pure white in flake form and clear when molten. Having high heat stability, it holds its clarity during processing. These quality features of National Phthalic Anhydride are especially valuable in light-colored resins and plasticizers.

And because we make a wide range of resin-chemicals, we are well equipped to serve your complete needs for Phthalic Anhydride and many other chemicals as well. For samples, quotations and other information, call or write our nearest office.

MALEIC ANHYDRIDE FUMARIC ACID ADIPIC ACID
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National Aniline Allied Chemical

1

Monel Alloy counters UF_6 attack on vulnerable lines and fittings

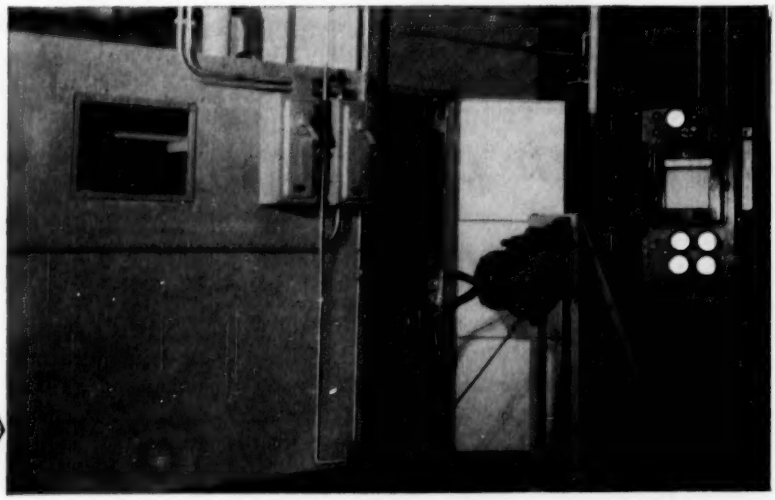


Cylinder of UF_6 is connected to Monel nickel-copper alloy lines that carry it to hydrolysis tank.

Two ways Inco Nickel Alloys assist in commercial production of nuclear fuel

2

Inconel Alloy reduces oxidation damage to batch trays and fixtures in 1500°F converting furnaces



Furnaces in which U_3O_8 is converted to UO_2 at 1500°F use Inconel nickel-chromium alloy trays.

Mallinckrodt Chemical Works is now producing commercially reactor fuels of uranium dioxide and other uranium compounds at Hematite, Missouri. The enrichment of these uranium products ranges from less than 1% U-235 to more than 90%.

These products are derived from UF_6 liquefied gas . . . hydrolyzed, precipitated as ammonium diuranate and dried to produce U_3O_8. To withstand attack by the highly corrosive UF_6, Monel* nickel-copper alloy lines are used to carry the gas from container to hydrolysis.

In further processing, batches of U_3O_8 are fired in cracked ammonia atmospheres at 1500° to make UO_2, suitable for use in pellet fuels. (A sintered material for use in matrix-type fuel elements is also made.) Inconel* nickel-chromium alloy trays and fixtures endure the severe heat and corrosive atmospheres.

Both these Inco Nickel Alloys are extensively used in construction of other corrosion- and heat-resisting equipment for production and concentration of uranium and uranium fuel materials. The Development and Research Division of Inco has helped solve many of the metal problems in this design area and can probably help with yours . . . if you say the word. *Registered trademark

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INCO TRADE MARK **Nickel Alloys**

LARGER SIZE RANGE

MIDWEST ELBOWS

IMPROVED DELIVERY

HEAVY WALL CARBON STEEL AND ALLOY



12" Long Radius
2¼" Wall Thickness
1¼% Chrome



20" x 10" Reducing
2" Wall Thickness
2¼% Cr—1% Mo.

STRAIGHT LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
36	1.250
30	2.000
26	2.000
24	1.500
20	1.375
18	2.250
16	2.125
14	1.750
12	2.000
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

These straight elbows can be furnished with LONG TANGENTS at no extra cost. All thicknesses less than those shown above are, of course, available.

The exclusive Midwest method of making all welding elbows from plate instead of tubing gives us a FLEXIBILITY OF MANUFACTURE that is much greater than by any other process. These heavy wall Midwest straight and reducing elbows are available in any material that can be secured as plate. The maximum wall thicknesses for which we now have equipment are indicated by the tables at left and right. And, because it is easier to get plate than tubing, better delivery is another advantage. Still another is the close tolerances inherent in our process.

Quality control goes beyond all code requirements. The longitudinal weld of every heavy wall elbow is completely X-rayed as standard procedure in our method of manufacture.

You will find it to your advantage to send us your inquiries.

REDUCING LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
30	2.000
26	*
24	2.000
20	2.000
18	2.000
16	1.500
14	1.750
12	2.250
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

Reductions to all nominal pipe sizes down to ½ large diameter. All thicknesses less than those shown above are, of course, available.
*Refer to factory.

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—Photo courtesy Standard Oil Company (N.J.)

How preheat makes a "30-hour day"

When you add a Ljungstrom® Air Preheater, your on-stream stills can give 30 hours of normal production in every 24 hours. That's more than an extra week of production every month!

The reason is that Ljungstroms recover valuable BTUs that are normally dissipated up the stack. By putting this heat back to work, higher flame temperatures are generated, heat transfer rates increased. You can save one barrel of fuel in every five, stay on-stream months longer because slag is virtually eliminated.

LJUNGSTROMS ARE WRITTEN OFF FAST

A Ljungstrom can pay out in nine months or less! The many other advantages show why: use of fuels you formerly threw away . . . more economical furnace design with no need for convection surfaces . . . minimum slag . . . shorter turn-around time . . . higher quality product (averaging 2 octane numbers higher than previously).

Detailed information is available. Learn about Ljungstrom's compactness, easy inspection, simplified cleaning. minimum maintenance, and the amazing economy and reliability story. Just call or write the Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.



The Air Preheater Corporation

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NEW CHIKSAN DISCPAK SWIVEL JOINTS



FOR STEAM AND HOT GAS SERVICE

Created specifically for service on lines employed in steam and hot gas service, the Chiksan Discpak embodies a new construction design which permits packing units to be replaced without removing the joint from the line. The outer housing of the Discpak is cut apart at the packing chamber and both ends are flanged at the cut. Four allen-type cap screw bolts are used to secure the flanges. A disc-seal, housed between the two members, provides a fluid-tight seal between rotating and stationary members of the Discpak Swivel Joint. A spring loaded pressure plate holds the packing in sealing position against the swiveling member.

The new Discpak has a maximum temperature rating of 600° F. and a maximum pressure rating of 300 psi. All turning movement in the Discpak takes place on a double row of precision ball bearings. Write today for literature and prices. If your plant or equipment lines utilize hot gas or steam, it will pay you to know about this new field-proven Discpak swivel joint.

REPLACE SEALS WITHOUT REMOVING JOINT FROM THE LINE



To replace the disc-seal, simply remove four allen screws and spread line slightly with a flat metal bar.

CHIKSAN

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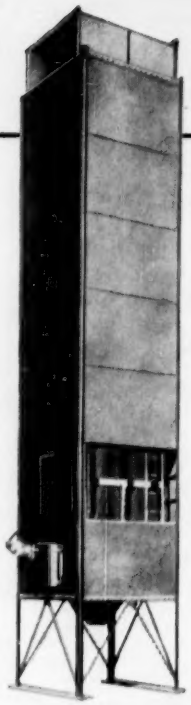
New Discpak Bulletin 100 describes in detail the many features of this new swivel joint including full mechanical specifications

57-26

The latest advancement in dust recovery

Dualaire*

REVERSE-JET DUST COLLECTOR!



- *Cleans without jarring or rapping!*
- *Maintains uniformly low pressure drop!*
- *Field-proven efficiency as high as 99.99%!*



Backed by the same organization that pioneered commercial application of COTTRELL Precipitators and MULTICLONE Collectors, the DUALAIRE Reverse-Jet Dust Collector is revolutionizing filter-type recovery systems. The DUALAIRE gives you vital advantages like these . . .

REVERSE-JET CLEANING ACTION cleans the filter tube continuously in small increments—not with sudden surges as in rapping or jarring.

CLEANING ACTION starts automatically and stops automatically to keep pressure differential within low pre-set range.

FILTER EFFICIENCY remains uniformly high at all times because no thick filter cake ever forms to reduce operation effectiveness. Actual field tests show efficiencies as high as 99.99%!

NO STANDBY UNITS, with their complicated switching devices, are needed. The DUALAIRE is cleaned as it filters—without interruptions or shut down periods for cleaning. The operation is continuous!

FILTER UNITS LAST LONGER because they are not subjected to intermittent jarring, rapping or vibration—all destructive to filter fabrics.

The above are only a few of the many important advantages you get in DUALAIRE Dust Collectors. A new 8 page booklet gives the full story . . . explains how reverse-jet cleaning action works—provides facts, figures and illustrations that will change your thinking on filter-type recovery systems. Send for your free copy of this descriptive booklet—or see your nearest Western Precipitation representative!

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U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

Protein Nutrient Balance Stressed in Newly Revised Study of Amino Acids

The role of amino acids in maintaining protein quality in poultry and livestock is given special emphasis in the fourth edition of "Proteins and Amino Acids in Animal Nutrition", by Dr. H. J. Almquist, recently published by U.S. Industrial Chemicals Co.

Considerably revised and expanded, the 32-page reference work includes information on the latest research in the field of amino acids. Tables on the amino acid composition of common poultry feedstuffs have been enlarged, and several pages have been devoted to the effects on protein quality of heat treating soybean meal.

Copies of this useful reference work can be obtained from U.S.I. sales offices or by writing to the Editor, U.S.I. Chemical News.

Field Ion Microscope Uses "Matter Waves" To Visualize Atoms

A new instrument called a field ion microscope substitutes the incredibly short waves associated with atomic nuclei for those of visible light to resolve the images of atoms in metals.

In principle the microscope is a very simple device, resembling a TV tube. It has a fluorescent screen and a fine tungsten needle corresponding to the electron gun that paints the picture on the TV screen.

A high voltage strips helium atoms of their electrons, and their nuclei then drift to the point of the needle. A powerful electric field applied between the tip of the needle and a second electrode in the tube hurls "matter waves" associated with the nuclei against the screen. Here the atomic pictures appear at a magnification of 10 million diameters.

The technique is presently limited to the study of hard, simple metals, but these may serve as models for the study of others.

Molded Polyethylene Drums Pass Army Chemical Corps Rough-Handling Tests

Polyethylene Containers in Steel Overpacks Promise Easier, Safer Handling and Storing of Corrosive and Sensitive Materials

A series of rough-handling evaluation tests of four types of overpacks carried out by the Army Chemical Corps indicates that containers of molded polyethylene in steel overpacks can reduce the costly breakage often experienced in shipping corrosive and sensitive materials.

Breakage sometimes exceeds 10% when material of this kind is shipped in boxed carboys and carboy bottles. This can be reduced considerably by polyethylene packaging according to a recent article in "Armed Forces Chemical Journal" by Kenneth D. Brunelli, Chemical Warfare Laboratories, Army Chemical Center, Md.

Used 18 Drums In Various Sizes

To make its evaluation the Army Chemical Corps used eighteen molded polyethylene drums in 55-, 30-, 15-, and 5-gallon sizes, encased in overpacks. These overpacks were open-flange steel drum, solid-head steel drum, open-flange plywood drum, and wirebound crate. Also included were two molded polyethylene drums without overpacks.

Tests were conducted according to the standard procedures of the Chemical Corps for material for this use, and consisted of (1) a two hour vibration test, performed on all plywood overpacks and half of the steel and wirebound overpacks; (2) a six foot free fall onto concrete; (3) an incline-impact test, performed on the overpack units only; and (4) a leakage test. All containers were filled with water to 98% of capacity.

Polyethylene Units Showed High Degree of Burst Strength

Polyethylene units without overpacks showed a high burst strength. They withstood the drop test, including a drop onto a 4 x 4 timber from a height of over six feet.

MORE

Defense Needs Help Define Role of Chemical Industry

The chemical industry's awareness of defense needs is important to its own prosperity and the nation's survival, it was pointed out at a recent meeting of the Chemical Buyers Group of the National Association of Purchasing Agents.

This awareness is important to the industry, because new military uses for chemicals often point to profitable commercial applications.

It is important to national survival in case of attack, since much of the defense program depends upon continued production of chemicals for military equipment and civilian supplies. Awareness of recovery plans for industry will aid in a faster return to production and orderly flow of materials to defense programs, a government spokesman said.

The chemical industry is being encouraged to plan for continuity of management, to store plant designs, production techniques, research data, and other essential records, and to provide for plant disaster control.

Polyethylene Drum in Steel Overpack Reduces Breakage



These are representative views of combination containers following rugged tests by Army Chemical Corps. (A) Five-gallon molded polyethylene drum tested without overpack is still intact after drop. (B) Thirty-gallon polyethylene drum with open-flange steel overpack is still intact following a six-foot drop on a 4" x 4" timber. The leak that developed at plastic plug closure was readily stopped by tightening closure. (C) The drum of 55-gallon capacity with plywood overpack splintered following diagonal drop. (D) Drum in wirebound crate is still serviceable after three drop tests.

U.S.I. CHEMICAL NEWS

CONTINUED

Polyethylene Drums

The polyethylene drums in combination with the steel overpacks gave the best protection to their contents, the report said. These overpacks were, however, deformed during the tests.

All of the plastic drums in the steel overpacks came through undamaged except for one 5-gallon size, which was punctured by the steel handle of its overpack.

The plywood and wirebound crate overpacks splintered under the rough usage, and the nails and staples of the plywood overpacks punctured the plastic.

Although leaks developed at the plastic plug closures following the drop tests, the leaks were stopped in every case by simply tightening the closure.

Structural Failure Noted Only in One

Of the twenty polyethylene drums tested, structural failure was noted in only one—a split along the top rim of a 30-gallon drum with plywood overpack.

As a result of these tests, it is reported that the Chemical Corps has recommended consideration of polyethylene drums in steel overpacks to replace glass or ceramic liners in rigid shipping containers for corrosive and sensitive materials that are compatible with polyethylene.

New U.S.I. Data Sheets On Organo-Aluminum Compounds Available

Data on four new organo-aluminum compounds, now available from U.S.I. in pilot plant quantities, are contained in recently published technical data sheets. The properties of ethylaluminum and methylaluminum sesquichlorides, trimethyl and triethyl aluminum are described in four separate sheets.

The sesquichlorides are not true chemical compounds but mixtures of alkyl aluminum dichlorides and dialkyl aluminum chlorides.

Trimethyl and triethyl aluminum are being tested as ignitors and fuels for jet engines. The entire group also shows possibilities as polymerization catalysts and as intermediates for chemical synthesis.

Titanium and Zirconium Studied for Surgical Uses



Titanium and zirconium have received more and more attention as materials for special surgical appliances, according to recent literature.*

Treatment of simple fractures is reputedly successful using titanium in a multiple plate technique without plaster immobilization. Tests on laboratory animals indicate that biological tolerance is high.

In one reported test, titanium discs were inserted into muscle, and the reaction compared with controls of tantalum, sterling silver and phosphobronze. After seven months the titanium was found to be inert and enclosed with a fibrous tissue capsule.

Lightweight, ductile zirconium has been tested for suturing, pegs, screws, and skull plates. Zirconium compares well with tantalum, it was said, causing no measurable reaction in muscle fascia, bone, or brain, and proved superior to silver. Hemostatic brain clips of zirconium can be flattened more uniformly and hold better than those made of tantalum.

In general, comparisons between tantalum and silver and stainless steel on the one hand, and titanium and zirconium on the other, reveal net advantages for the latter two in terms either of corrosion resistance, weight, elasticity, ductility, or cost.

**References*

Surgery, 39: 470-3 (1956); *Surg. Gynecol. and Obst.*, 87, 212 (1948); *Jour. Neuro. Surgery*, 5: 359-363 (1948); *Jour. Neuro. Surgery*, 5: 342-348 (1948); *Surg. Gyn. & Obst.*, 71: 598 (1940); *J. Bone and Joint Surgery*, 33-A: 473 (1951).

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U. S. I.

An antiseptic coating material can be applied to objects which are handled by the public but seldom washed. It is applied by dipping, spraying or brushing, is useful for many personal articles as well. **No. 1271**

Continuous sodium dispersion technology is described in a new USI brochure. Contains latest information on time-saving continuous preparation of dispersers. **No. 1272**

A strippable coating is available as a protection for metals and other surfaces against alkali and acid solutions, plating solutions, etc. Can be sprayed, brushed or rolled on. Thick coating is reusable. **No. 1273**

Three controlled-viscosity release agents for rubber and plastic molding and for die casting of certain alloys have been developed. They are said to be odorless, smokeless, non-corrosive, non-toxic. **No. 1274**

An aerosol dispenser for gibberellin, a new plant growth stimulant, has been developed. A glass vial with a metered valve provides measured dosages, is said to be both convenient and accurate. **No. 1275**

New developments in laboratory equipment now commercially available include corrosion testers, refrigerated centrifuges, stainless steel refrigerators, test cabinets, magnetic stirrers. **No. 1276**

The technology of liquid metals is discussed in a recent collection of papers now on sale in book form. The work deals with many aspects of the subject from the standpoint of the chemical engineer. **No. 1277**

For joining, filling, cladding, and surfacing masonry materials, three new plastic compounds are available. A brochure describes properties of the compounds and gives instructions for their use. **No. 1278**

Simple castings for atomic shields can be made from a new polyethylene-lead compound. The ratio of polyethylene to lead is variable for effective shielding against specific types of radiations. **No. 1279**

The making of glass-reinforced epoxy impressions is discussed in a new booklet. Applications of this widely used system are found in metalworking and model and pattern reproduction fields. **No. 1280**

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Intermediates and Fine Chemicals: Acetoacetarylides, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate solution, Urethan USP (Ethyl Carbamate).

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Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

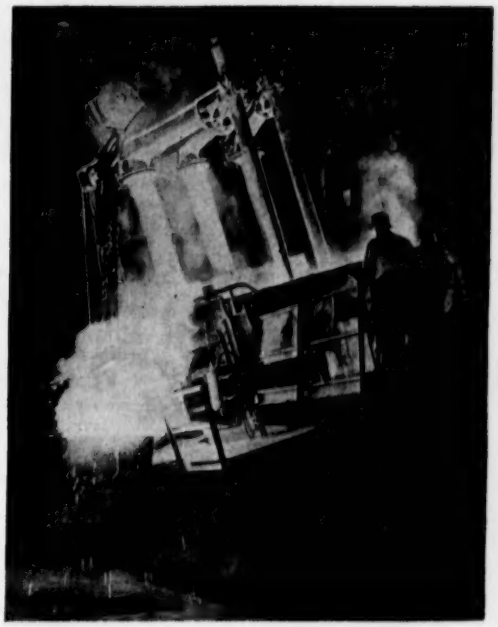
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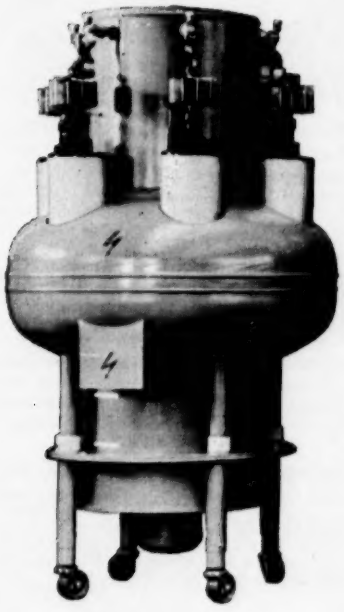
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by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt



How Large Plants Reduce Costs of Salt Handling and Brine Making

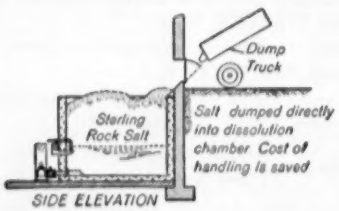
Many of today's large users of brine are saving money on salt deliveries, on handling salt in the plant, and on the production of saturated brine . . . by installing one rugged, permanent piece of equipment, a Storage Lixator. This unit (the exclusive development of International Salt Company) is a large combination salt-storage and salt-dissolving tank.

The Storage Lixator is strong—can easily hold the weight of heavy trucks or railroad cars. It's adaptable—can be located almost anywhere, either below or above ground, either inside the plant or outside. It's fully automatic—continuously replenishes whatever amounts of brine are drawn off through the piping system to points of use. And it needs no maintenance.

Another money-saving feature: with the Storage Lixator, brine-storage tanks are rarely necessary. This is because International's Lixate principle, on which every Storage Lixator is based, makes use of "Wet Storage"—meaning that undissolved salt is stored in the same tank with saturated brine. Even when the Lixator is completely filled with salt, there is ample room between the salt crystals for storing fully saturated brine.

The operation of every Storage Lixator is basically the same, but there are many design possibilities, by which International's Lixate principle can be adapted to any plant requirements. Here are some typical Storage Lixators, showing how they are engineered to meet specific needs.

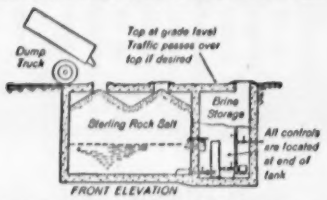
1. The Inside Single-Compartment Storage Lixator . . . ideal for congested areas where outside property is not available.



Salt is dumped from a truck directly into the dissolving chamber (the Lixator is just inside the plant wall), and salt-handling costs are reduced. The Lixator controls are easily accessible from inside the plant.

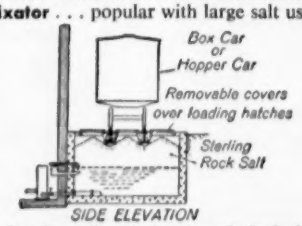
2. The Shed-Type Storage Lixator is very practical for small-scale storage and dissolving operations when space is available adjoining the plant building. Large doors permit easy salt entry by portable conveyor belt fed directly from a dump truck or railroad car. With this setup, any available space can be used for an inexpensive brine-making unit inside the shed.

3. The Integral Brine Tank Storage Lixator . . . one of the best for manufacturing operations which require large amounts of fully saturated brine only at certain times. (The brine-storage tank included in the Lixator can be made as large as necessary.) Because the top of this Lixator is at ground level, traffic can pass over it—and delivery trucks can pour salt directly into the loading manholes.



4. The Underground-Tank Storage Lixator is a single-compartment rock-salt storage and dissolving unit which adjoins a railroad siding. With the top of the Lixator on the same level as the floor of the railroad car, salt delivery by power scoop, or portable conveyor belt is an easy operation. Fully saturated brine, made automatically in this Lixator, can be pumped any distance to the points of use.

5. The Undertrack Dual-Unit Storage Lixator . . . popular with large salt users.



It has been found that its relatively high installed cost is more than offset by the most inexpensive salt delivery method known today (and possible only with this undertrack design). A railroad hopper car passes over the Lixator, and salt drops directly into storage. No conveyor belt is needed, and salt delivery is entirely automatic.

6. The Dual-Compartment Storage Lixator is designed for plants which use exceptionally large amounts of saturated brine. There are two separate dissolving compartments, storing an ample supply of brine for every need. The control room is located between the two storage and dissolving chambers. This unit, with its extra-large storage capacity, permits very economical purchasing and handling of salt.

There are many other types and designs of Storage Lixators—along with numerous refinements to suit your particular needs.



TECHNICAL SERVICE WITH YOUR SALT

Through skilled and experienced "Salt Specialists," International can help you get greater efficiency and economy from the salt you use. International produces both Sterling Evaporated and Sterling Rock Salt in all types and sizes. And we also make automatic dissolvers in metal or plastic for both kinds of salt. So we can recommend the type and size of salt most perfectly suited to your needs.

If you'd like the assistance of an International "Salt Specialist" on any problem concerning salt or brine—or further information on Storage Lixators—just contact your nearest International sales office.

International Salt Co., Scranton, Pa.

Sales Offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR INDUSTRY, FARM, AND THE HOME—
STERLING SALT
PRODUCT OF INTERNATIONAL SALT CO., INC.

Fact:

Rugged Westinghouse Industrial Heaters available in 24 Sizes . . . 8 Coil Selections . . . 150 Ratings from 100,000 to 2,500,000 BTU/hr . . . 2,000 to 25,000 CFM each



HEAVY-DUTY COIL. Tapered steel fins bonded to 1" wrought iron pipe—with internal steam distributing pipe—solder dipped for permanent bond and corrosion resistance.

1. Proven, Westinghouse-manufactured, extended surface heating coils good for continuous operation up to 200 psig.

2. Die-formed casings with rounded corners eliminate accidents and dirt catching pockets. Front and back panels easily removable.

3. Multiple louvered outlets for efficient distribution of heated air.

4. Self-aligning, grease-lubricated ball bearings mounted outside casing, readily serviceable.

5. Face and by-pass dampers permit continuous air circulation to maintain uniform temperatures.

NOTE: Louver type mixing box accessory permits introduction of fresh air for make-up and ventilation, with or without filters.

Solve your space heating problems with Westinghouse-Sturtevant Industrial Heaters. Eliminate cold, drafty conditions caused by excessive cold infiltration through leakage or exhaust.

Two Types With Wide Applications:

GENERAL PURPOSE HEATER . . . For manufacturing areas, warehouses, garages, commercial buildings—with standard non-ferrous heating coils.

HEAVY-DUTY HEATER . . . For continuous-duty high-pressure systems, or industrial process work—with wrought iron heating coils.

The compact packaged engineering of every Westinghouse-Sturtevant Industrial Heater provides units for mounting on floor, walls, or suspended from ceilings. In short, they can be placed where they will do the most good, and can be relocated to meet any change in plant layout.

Every unit is backed with a Westinghouse exclusive—*one warranty*. Only Westinghouse makes all principal components—Fans, Heating Coils, and Motors. You can get unit engineering and single equipment responsibility.

MORE FACTS? To find out how to solve your particular heating problem, call your Westinghouse-Sturtevant Sales Engineer . . . he is the "Man With The Facts" on heating, air handling, and electronic air cleaning . . . or fill in coupon below.

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YOU CAN BE SURE . . . IF IT'S

Westinghouse

J-80427

Westinghouse Electric Corp.
Sturtevant Division, Dept. 4A
Hyde Park, Boston 36, Mass.

Please send more information on your Industrial Heaters.

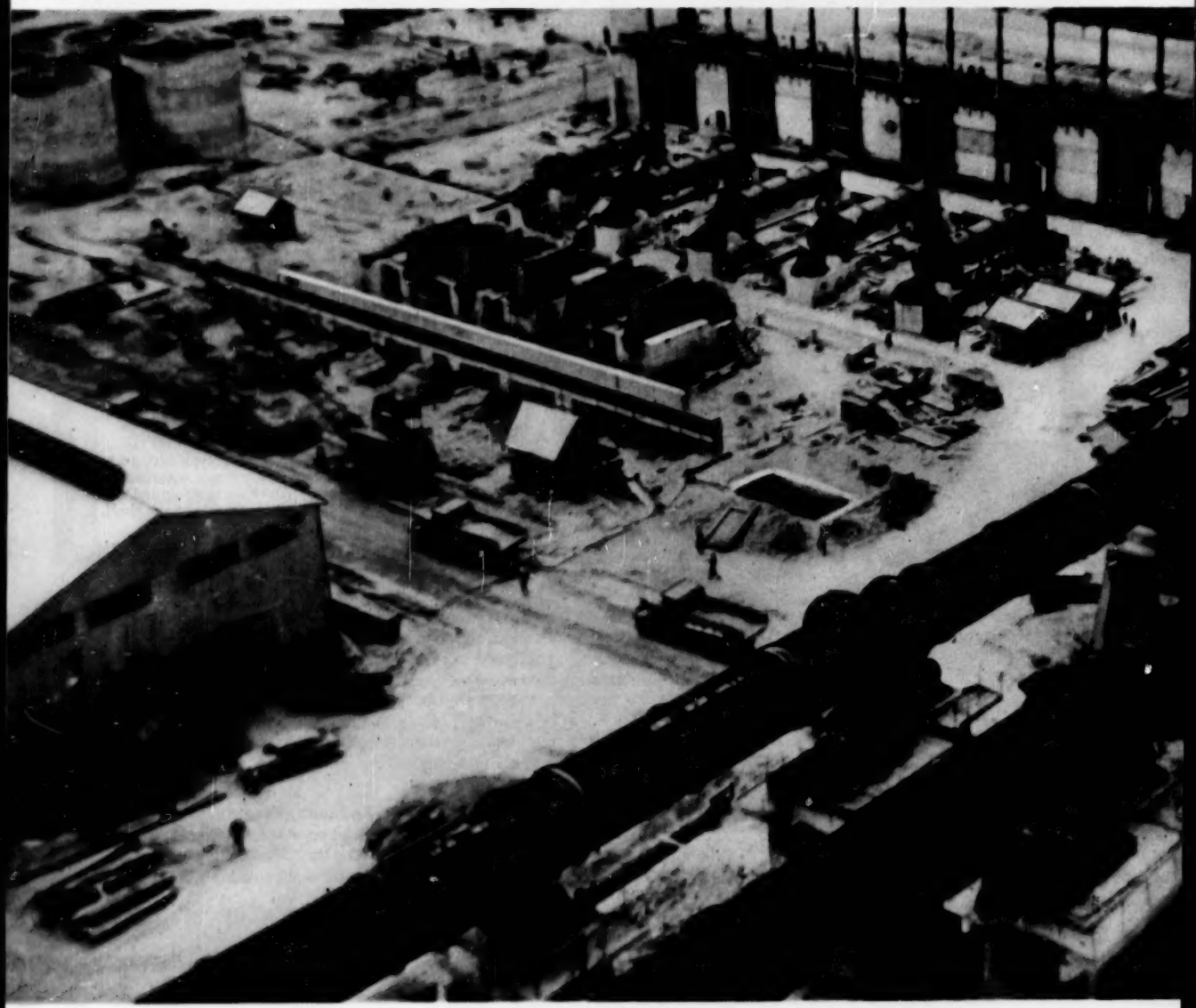
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COMPANY .....

CITY ..... STATE .....

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for GRESIK CEMENT



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ACHIEVEMENT

Plant . . . Capacity 5000 barrels per day
COMPANY, Island of Java, Indonesia



One of the world's most modern Cement Plants . . . Equipped with Kennedy Machinery.

Asia's most modern Cement Plant.

KENNEDY PRODUCTS

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- Swing Jaw Crushers
- Slugger Rolls
- Ball Mills
- Vibrating Screens
- Rock Feeders
- Air Swept Tube Mills
- Rotary Kilns
- Coolers, Dryers
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- Hoists, Conveyors
- Classifiers
- Pneumatic Transport Systems
- Dust Collectors
- Complete Cement Plants
- Complete Lime Plants
- Waste Heat Boilers
- Pulverized Coal Firing Systems

NEW CEMENT PLANT OPENS IN INDONESIA

Special to The New York Times.

JAKARTA, Indonesia, Aug. 7—Asia's most modern cement plant, an impressive example of Indonesian-United States cooperation, was formally dedicated today by President Sukarno in East Java.

The ceremony in the newly constructed industrial compound at Gresik, near Surabaya, represented an important event in the history of underdeveloped Indonesia, now struggling through her worst economic crisis. The cement plant, sprawling over several acres is expected to make a major contribution in helping strengthen the nation's economy and spur new industries.

From Gresik cement will be transported to scattered areas of the archipelago. Today's cement at Gresik will be tomorrow's new schools, houses, dams, hospitals, factories and bridges, all of which are badly needed by Indonesia's 82,000,000 people.

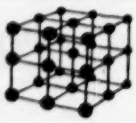
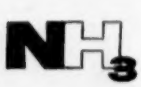
In a dedication speech, as reported here, President Sukarno thanked the United States for financial and technical cooperation in building the Gresik works.

Cement experts said the plant had a capacity of 250,000 tons of cement a year, about 75,000 tons more than total present production. They said the plant was expected to save Indonesia about $7,000 a day in foreign exchange.

Aerial view of Gresik Cement Company Plant, Island of Java, Indonesia

Reprinted from
The New York Times, August 8, 1957

Send for Bulletins describing Kennedy Machinery and Equipment

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Check your products on this list, then

INVESTIGATE Rockwell-Built EDWARD VALVES

for your process!

With the frontiers of chemical research and development pushing ever outward . . . with new products and processes the order of the day . . . NOW is the time to get the help you need in valving liquids, gases and solids-in-suspension. For Edward, long-time leader in the field of cast and forged steel valves, spends *more*, proportionately, for steel valve research than any other valve manufacturer. The results of this continuing substantial investment are at your disposal. Technically trained, thoroughly experienced, your Edward Valves Representative can supply a wealth of practical information on valve selection, installation, operation, maintenance and repair. This man is at your service . . . a card or a call will bring him. Why not get in touch with us *today?*

EDWARD BUILDS . . . a complete line of forged and cast steel valves; from ¼" to 18"; for pressures up to 7500 psi; with pressure-seal, bolted, union or welded bonnets; with screwed, welding or flanged ends.

- **Globe Stop Valves**
- **Angle Stop Valves**
- **Gate Valves**
- **Non-Return Valves**
- **Check Valves**
- **Blow-Off Valves**
- **Stop-Check Valves**
- **Relief Valves**
- **Hydraulic Valves**
- **Instrument Valves**
- **Gage Valves**
- **Special Designs**

In the Edward Line are valves ideally suited for services involving water, steam, air, gases, dowtherm liquids, hydrocarbons, alcohols, ammonia, animal and vegetable oils, brines, caustics, solvents, sugar liquors and many other fluid substances.

Edward Valves, Inc.

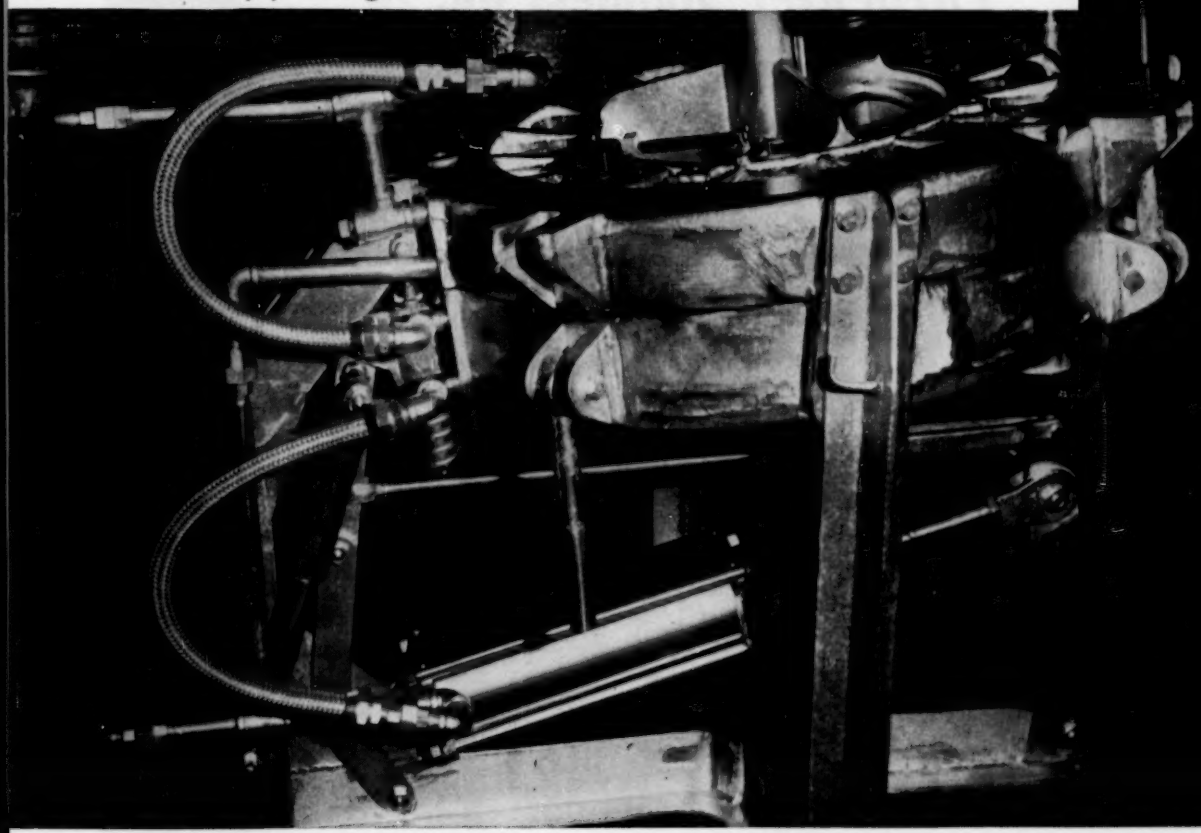
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ROCKWELL MANUFACTURING COMPANY

1224 WEST 145TH STREET, EAST CHICAGO, INDIANA

Where your problem is pipe that must flex

reduce pipe fatigue with American flexible metal hose



300°F, 50 lb. pressure is met by American Flexible Bronze Hose connecting moving steam chambers on Super Mold tire capping equipment.

"American flexible metal hose is tops for trouble-free service!" says C. R. Lohr of the Super Mold Corporation. Since 1940, American flexible metal hose has been conveying steam between moving parts on Super Mold tire capping equipment.

Whether frequency of flexure is a few times a week . . . or a thousand times an hour . . . you'll find American flexible metal hose is tight, safe, long lasting, easy to install. In field and laboratory tests American flexible metal hose has flexed millions of times without sign of failure.

Problems Solved by American Flexible Metal Hose

American flexible metal hose absorbs vibration and prevents its transmission to surrounding structures . . . absorbs expansion and contraction in lines due to temperature changes . . . facilitates installation especially in cramped spaces . . . solves the problem of misalignment.

Available in wide range of diameters in tough bronze, steel, super nickel, brass, stainless steel and other metals. American hose, complete with fittings, is made to your specifications and ready for immediate installation.

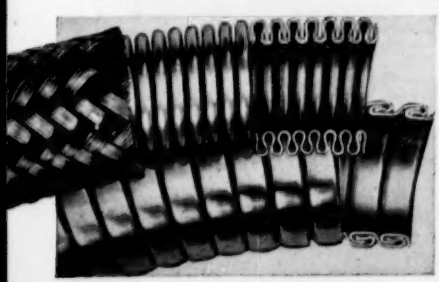
Consult your nearby American Metal Hose representative for engineering help when planning your next job. No obligation. See American Brass Company or Anaconda in your phone book — or write: American Metal Hose Division, American Brass Company, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Limited.

WHEREVER CONNECTORS MUST MOVE

56181 Rev.

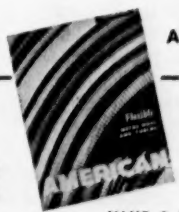
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AN **ANACONDA**® PRODUCT



BASIC TYPES

Seamless corrugated and Strip-wound. Both types available in a wide range of sizes and styles in any workable metal. Furnished with or without end fittings attached.



THE AMERICAN BRASS COMPANY
American Metal Hose Division, Waterbury 20, Conn.

Please send me a free copy of your new flexible metal hose and tubing catalog, G-560.

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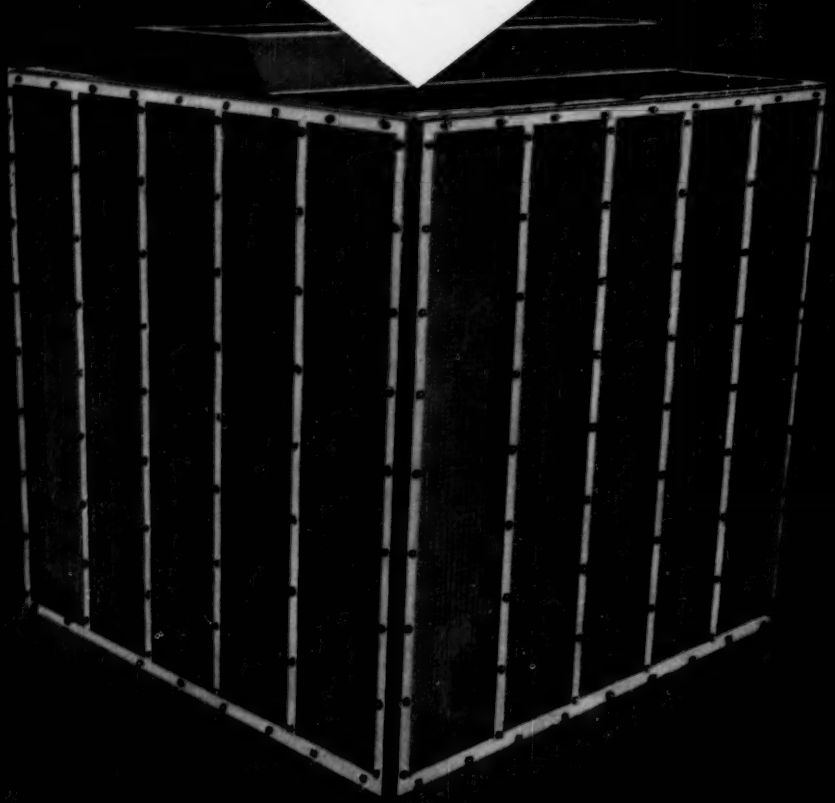
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resists attack by strong corrodents in uranium refining process!



Here's how one company solved a tough corrosion problem in setting up a new method of extracting uranium from ores.

Frame members and the 35 mesh screen which covers five sides of these 48" cubical shaped dipping baskets are made of Carpenter Stainless No. 20 for super corrosion resistance.

The baskets are loaded with ion-exchange resin and agitated in a tank through which flows slime bearing sulphuric acid pulps containing uranium in solution. In this process, the uranium values are removed from the solution and retained in the resin. Later these uranium values are removed with a nitrate solution, then precipitated as a refined, high-grade salt.

Carpenter Stainless No. 20, available in 8 forms, is a proven material for super corrosion resistance in the nuclear energy field. Call your nearest Carpenter Distributor or talk to our mill specialists now.

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Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Carpenter

Stainless No. 20 and No. 20Cb

***Carpenter* No. 20 bars, strip, wire and billets are available also from The Carpenter Steel Company, Reading, Pa.**

Why CELANESE CORPORATION OF AMERICA uses this modern materials handling method at two of its plants

THE DEMPSTER DUMPSTER® SYSTEM

What are the characteristics of your waste materials. We have a DEMPSTER-DUMPSTER container designed especially for you.





1. DEMPSTER-DUMPSTER sets down empty container.



2. Then picks up container loaded with slurry.



3. Hauls to dump where container . . .



Above you see a Skip Type Container handling wastes collected in barrels.



Crane Boom Extension — transferring welding machine.



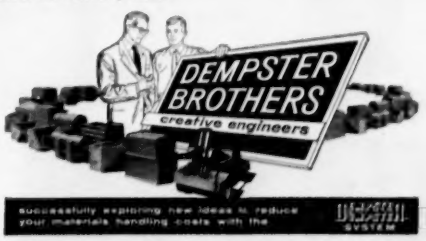
CELANESE also uses the DEMPSTER - DUMPSTER SYSTEM in construction projects in the plant area.

Handling bulk quantities of wastes is a costly problem by conventional methods. CELANESE Corporation of America officials solved their problem at plants in Pasadena, Texas, and Rock Hill, S. C., with the DEMPSTER-DUMPSTER SYSTEM.

These pictures of the DEMPSTER-DUMPSTER SYSTEM in operation at Pasadena give you a plant site picture of the many materials handling jobs accomplished at low cost by this highly efficient system. The pictures show how DEMPSTER - DUMPSTER Detachable Containers are handled. The empty container is being set down. Then the truck-mounted DEMPSTER-DUMPSTER services a loaded container.

After the chains are engaged to the lifting pins, all other operations are controlled hydraulically from the cab. The Crane Boom Extension on the DEMPSTER-DUMPSTER is an accessory CELANESE uses to increase the versatility of the system to handle miscellaneous self-contained products and machinery.

You, too, can make substantial reductions in materials handling costs, increase your efficiency, and improve plant cleanliness with the DEMPSTER-DUMPSTER SYSTEM. Write us today for complete information. *Manufactured by Dempster Brothers, Inc.*





4. . . . is emptied simply and quickly . . .



5. . . . by means of hydraulic controls in truck cab.

DEMPSTER BROTHERS, 2107 Dempster Building, Knoxville 17, Tenn.

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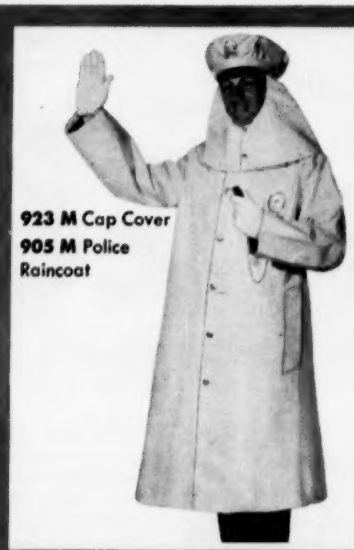
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Remember AO "Protectocote" won't peel or crack in normal work use . . . it's lightweight for comfort, contains no loaders . . . it won't stick in hot weather or become stiff in cold . . . it's easily, safely dry cleaned, laundered or scrubbed without injury. And it's work-styled to fit correctly. Ask your nearest AO Safety Products Representative, or write for new brochure.



7 x 139 NL Spat



923 M Cap Cover
905 M Police Raincoat



Utility Rain Suit
906 Jacket & Attached Hood
914 Overall Pants



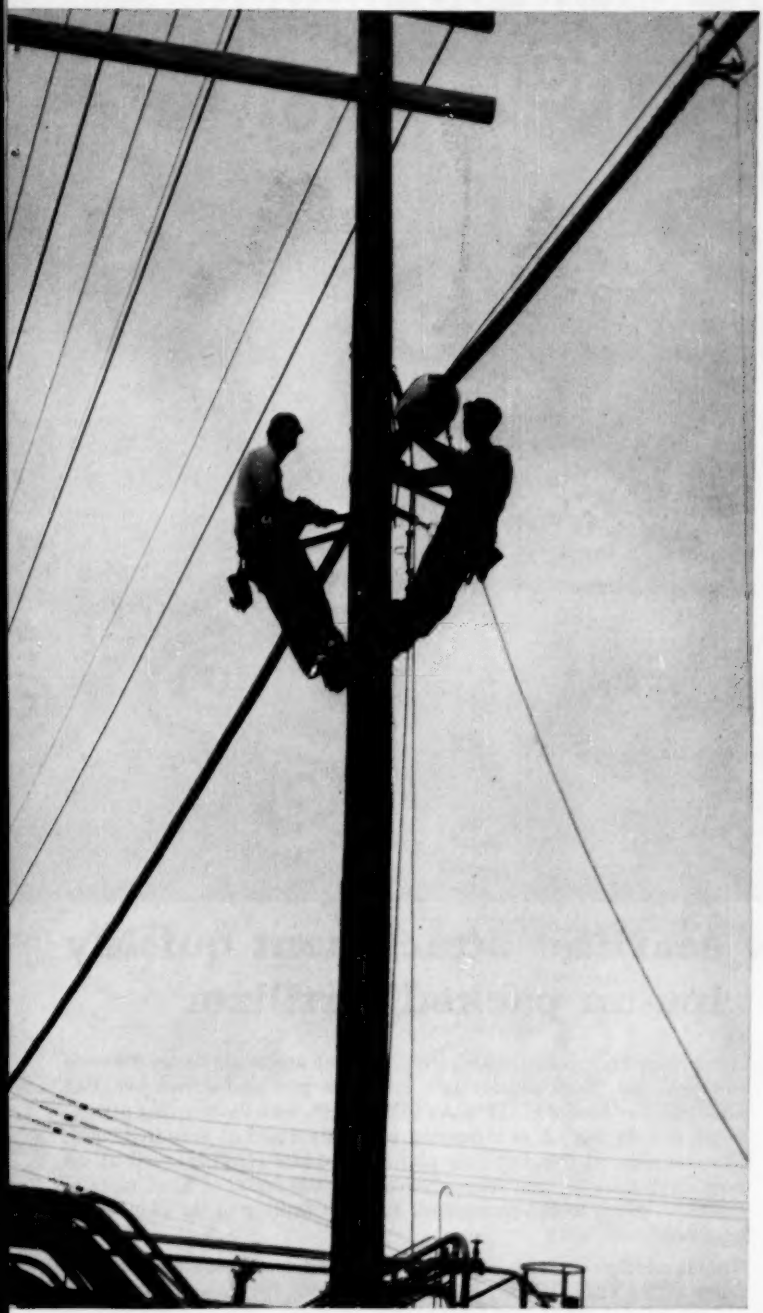
142 DCP Apron

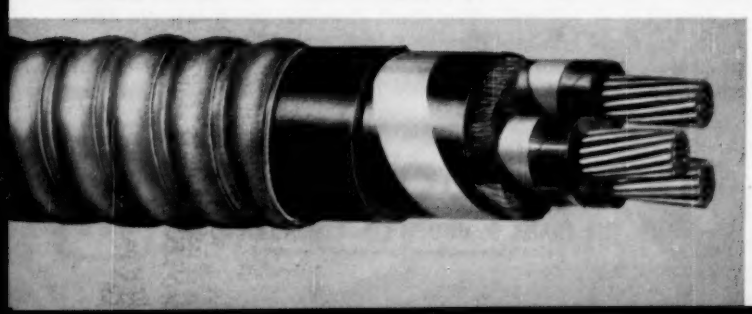
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American AO Optical COMPANY
SAFETY PRODUCTS DIVISION

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Speed new power on old poles—cut costs
with Anaconda Duralox Interlocked-armor Cable





METAL TAPE ARMOR AFFORDS HIGH PROTECTION AGAINST DAMAGE—NO CONDUIT NEEDED.

When a large Gulf Coast refinery needed additional power, the job was done *quickly* and *economically* because Duralox* could be strung on existing power-line poles—below the old lines. Neither new poles nor cross-arms were needed.

Installation time and costs are slashed with Duralox. Outdoors or in, it is readily trained around or over machinery, beams, piping and other obstructions in long, unbroken runs.

Duralox increases plant flexibility, affords easy maintenance and minimizes down time because it is generally accessible, easily relocated—100% salvageable. *Reg. U.S. Pat. Off. 87497

NEW BULLETIN DM 5606 contains full information about Anaconda Duralox Cable. Write for your free copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.



Ask the Man from

ANACONDA®
for DURALOX CABLE

EXISTING POLES are utilized at well-known refinery for additional power. Cable is Anaconda's 4/0 Awg Duralox Interlocked-armor Cable.

DURALOX CABLE is available in sizes No. 6 Awg to 750 Mcm—copper or aluminum conductors with rubber, plastic, or varnished-cloth insulation—up to 15kv. Underwriters' approved for 600 volts and 5000 volts, varnished-cloth insulation, galvanized steel armor!

PAYLOADER®

does 100 manhour job in 30 minutes





SCARIFIER ATTACHMENT
consists of 4 husky teeth hinged on a bracket behind the bucket. Teeth dig only when bucket is lowered and machine travels in reverse — do not interfere with normal bucket operation . . . are quickly removable.

New scarifier attachment quickly rips-up packed fertilizer

Removing the solidly-packed fertilizer that accumulates on concrete runways and floors usually is a laborious pick-and-shovel job. But now, the new Model HAH "PAYLOADER", with the scarifier attachment, can do the job in a fraction of the time and at very little cost. For example, at this fertilizer plant the Model HAH cleaned up an area in 30 minutes that formerly required 100 hours of hard, manual labor . . . much to the amazement and gratification of the plant management.

This is another example of how you get more and better performance from a "PAYLOADER". Standard operating features of the new, 1 cu. yd. Model HAH "PAYLOADER" include: 45° bucket roll-back at ground level; hydraulic load-shock-absorber; power-transfer differential; powerful breakout digging action; power-steering and hydraulic brakes. Ask your "PAYLOADER" Distributor to demonstrate what a Model HAH or other sizes will do for you. See him, or write us.

THE FRANK G. HOUGH CO.
754 Sunnyside Ave., Libertyville, Ill.

Send data on "PAYLOADER" tractor-shovels
☐ Model HA (18 cu. ft.) and HAH (1 cu. yd.)
☐ Larger models up to 2¼ cu. yd.

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THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
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8	66-7	104	149	188B	205	303	342i	378	404	448	L501	506E	515D	522F	536B	538D	544E		
9	69	105	151	188C	207	305	342j	379	405	449	R501	506F	515E	L523	536C	538E	544F		
10	69-70	106	153	188D	209	306-7	344	380	406	450	502	506G	516	R523	L531	538F	544G		
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16	71	107	159	190A	212	315	347	383	407b	454	502C	L507	516C	524B	531B	BR539	B545		
17	72	108	161	190B	212a	316-7	348	L384	408	456	502D	R507	516D	524C	531C	L540	545A		
18	73	109	163	190C	212b	316-7a	349	R384	409	457	502E	508	516E	524Ca	531D	R540	545B		
19	74	110	165	191	213c	316-7b	351	385	410	460	503	508A	516F	524D	531E	540A	545C		
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Important—For pages showing more than one advertised item, use this guide to numbers on cards above.

29-32 All items discussed
30a Tubes, aluminum heat exchanger
30b Process piping, aluminum
30c Pipes, aluminum steam-traced
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130 All items discussed
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130c Controls, self-powered cooling

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212c Filters, air intake
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217 All items discussed
217a Valves, check
217b Pipe support

221 All items discussed
221a Homogenizers, laboratory
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295 All items discussed
295a Mixers, top entering
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295c Mixers & seals
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316-7 All items discussed
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316-7 Tubing, aluminum heat exchanger
316-7c Tanks & vessels, aluminum
316-7d Fencing, aluminum

339 All items discussed
339a Drives, dry fluid

339b Roller bearings
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342 All items discussed
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342b Mills, ball
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342e Feeders
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392-3n Sodium benzoate
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478A-B All items discussed
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478Ab Microscope, field ion
478Ac Drums, polyethylene
478Ba Organo-aluminum compounds
478Bb Titanium & zirconium, surgical
478Bc Coating, antiseptic
478Bd Sodium dispersions
478Be Coatings, protective
478Bf Molding release agents
478Bg Gibberellin dispenser
478Bh Laboratory equipment
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478Bj Plastic compounds
478Bk Polyethylene-lead compound
478Bl Epoxy impressions

510A Resin sheets, porous

510Aa Car pullers

524C Controls, tension

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525C Meters & controls, Bul. G15-1

525Ca Monitor, moisture, Bul. 1834A

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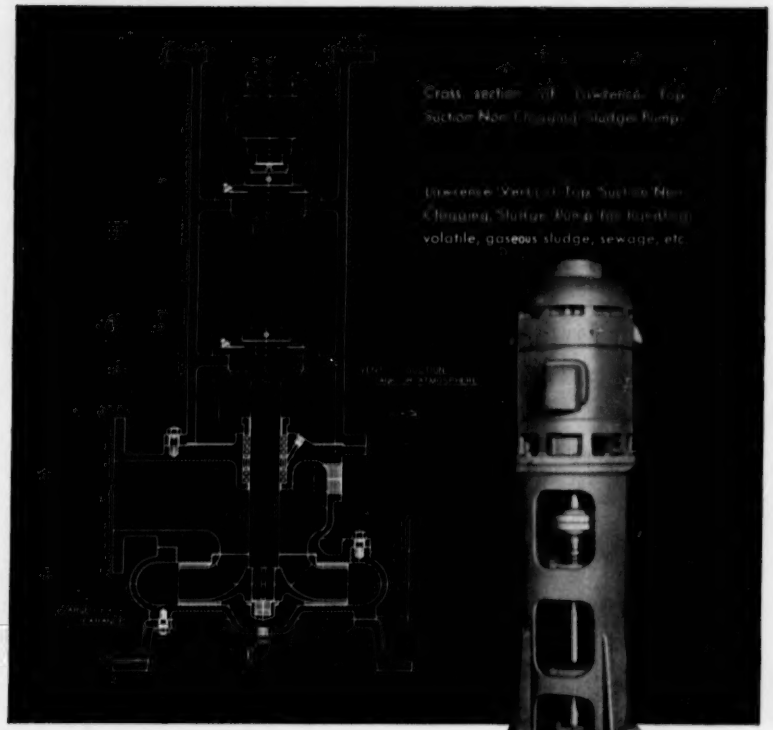
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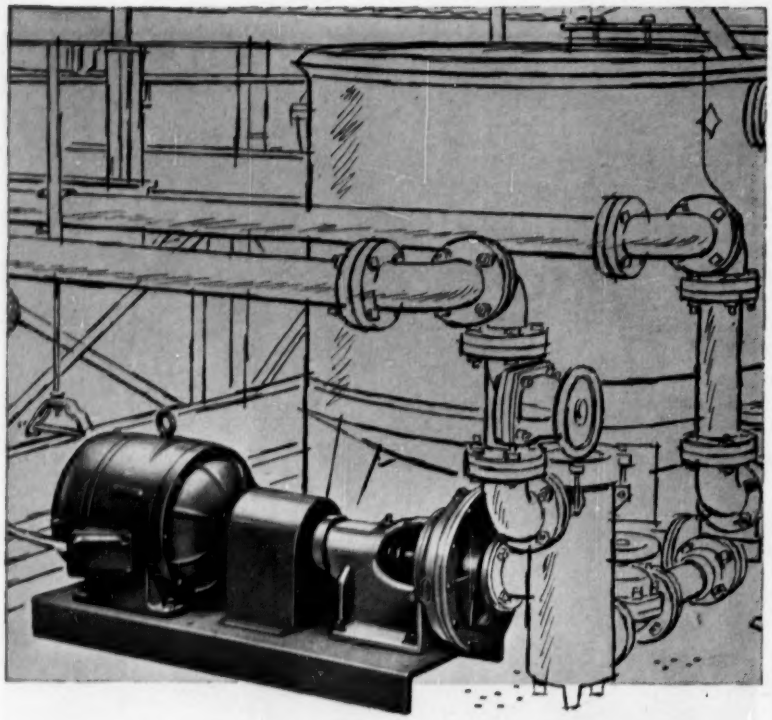
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This type of pump can operate with a very low Net Positive Suction Head (NPSH) and never become gas or vapor bound. It is made in all metals and alloys such as: — cast iron, bronze, stainless steel, Hasteloy, etc. — depending on the material pumped.

For further details on Lawrence Non-Clogging Slurry and Sludge Pumps write for Bulletin 206-4.



LAWRENCE PUMPS INC.
371 Market Street, Lawrence, Mass.



Corrosion Can't K. O. This Centrifugal Pump!

More than 108 different combinations

Speeds, 1750 to 3500 rpm

Capacities to 600 gpm.

Heads to 300 feet

It's an AMPCO — and it's engineered to combat velocity erosion and corrosion

Impellers and fittings are made from aluminum bronze or other workable alloys that resist the action of corrosive, abrasive media — instead of from commercial, tin-lead bronzes.

Impellers and volute shapes are designed to reduce internal turbulence and liquid-metal boundary velocities.

When process conditions change, you can alter your Ampco Pump to satisfy new requirements, easily and inexpensively. Ampco application engineers can suggest more than 108 pump combinations possible by interchanging stock components. A distributor near you has Ampco Centrifugal Pumps *in stock* — at no premium price. Write us for his name.

AMPCO METAL, INC.
Dept. CE-10, Milwaukee, Wis. • West Coast Plant: Burbank, Calif.

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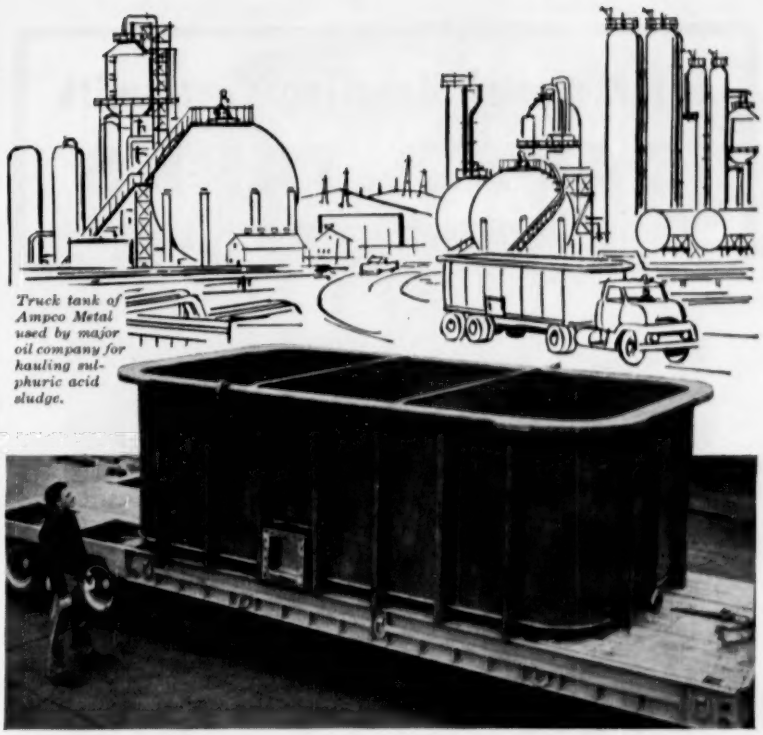


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Temperature R381



Truck tank of Ampco Metal used by major oil company for hauling sulphuric acid sludge.

Handles 35% Solution of Hot Sulphuric Acid Sludge

Truck tank...made from Ampco Metal Grade 8 plate...resists corrosion

Ampco Metal resists corrosion, erosion, and cavitation-pitting caused by...

Boiling sulphuric acid (up to 50%)

Hot concentrated caustic solutions

Fatty acids

Hydrofluoric acids

Abrasive solids in suspension

Other problem liquids and abrasives

Ampco Metal has exceptional resistance to the destructive attack of many alkaline and acid media.

That's one reason why this aluminum-bronze alloy is used in fabrications like the truck tank shown here; in pipe, fittings, and other forms.

There are other reasons, also:

(1) Ampco Grade 8 can be readily sheared, bent, formed, or deep drawn.

(2) It is easy to weld with Ampco-Trode* by the metal-arc, carbon-arc, MIG or TIG processes.

(3) It possesses high impact and fatigue strength.

You can get Ampco Metal in sheet, plate, extrusions, sand and centrifugal castings, pipe fittings, fasteners, tubing, pumps, valves, etc.

Ask your Ampco field engineer for further facts — or write us. *Reg. U. S. Pat. Off.

AMPCO METAL, INC.

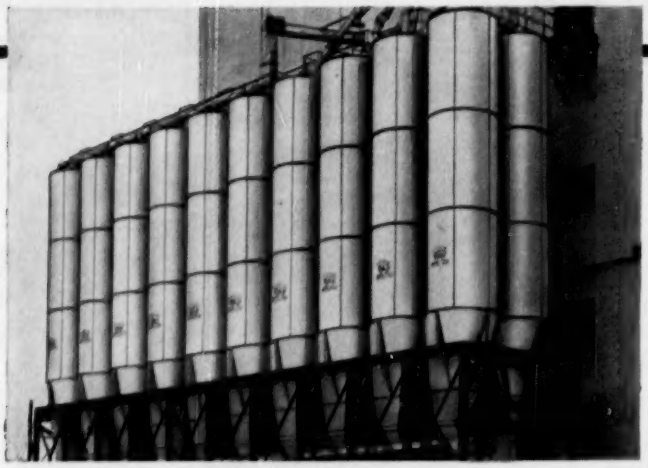
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THE METAL WITHOUT AN EQUAL



PR-24

Cut Material Handling Costs with DAY BULK MATERIAL TANKS

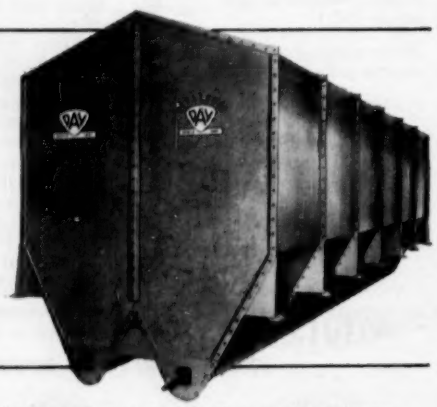


Each of these DAY vertical bulk material tanks has an approximate storage capacity of one carload. They serve as storage tanks for a packaging line as well as for truck and railcar loading. Every day more and more plants find large quantities of dry bulk materials can be handled more economically using DAY bulk material tanks. They save labor, containers and storage costs.

DAY bulk material tanks are made of black iron, galvanized or stainless steel. They are built and shipped in *easily erected, bolted sections*. Vertical tanks are furnished in sizes from 3 to 14 feet in diameter, up to 100 feet high. No support is required above the cone level. Patented, suspension discs are available for vertical type tanks to prevent bridging and assure free flow of product.

DAY Horizontal Bulk Material Tanks

Using DAY horizontal bulk material tanks, companies report savings of up to 25¢ per bag compared to handling bulk materials in bags. Ideal for buildings with limited headroom. Standard or special sizes available. Low installation cost.



For detailed information on bulk material storage tanks and pneumatic conveying equipment to suit your production and storage needs, write toDAY for Bulletins 529 and 549.

The **DAY** *Company*

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Made and sold in Canada by
The DAY Company of Canada Ltd.
P.O. Box 70N, Fort William, Ontario

Representatives in Principal Cities

DAY BULK MATERIAL HANDLING SAVES MONEY

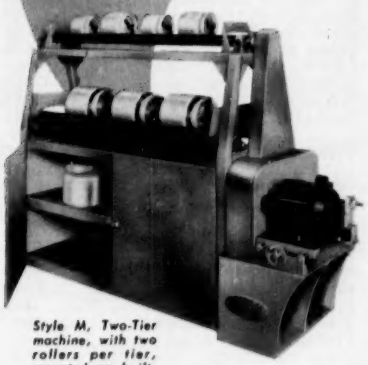
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MULTIPLE BATCH GRINDING WITH VERSATILE

abbé

JAR ROLLING MACHINES



Style M, Two-Tier machine, with two rollers per tier, mounted on built-in storage cabinet.

Multiple batches of similar or different materials can be economically ground, pulverized or mixed simultaneously on a versatile Abbé Jar Rolling Machine.

Jars, bottles or containers of different sizes can be used at one time. Each jar can be removed after its full grinding or mixing cycle has been completed—without stopping the machine.

Modern, rugged Abbé Jar Rolling Machines are available to handle single or parallel rows of jars, and in double or triple tiers for processing as many jars as required. Standard porcelain or steel jars range in size from 1 quart to 6 gallons. Built-in storage cabinets on tiered machines are optional.

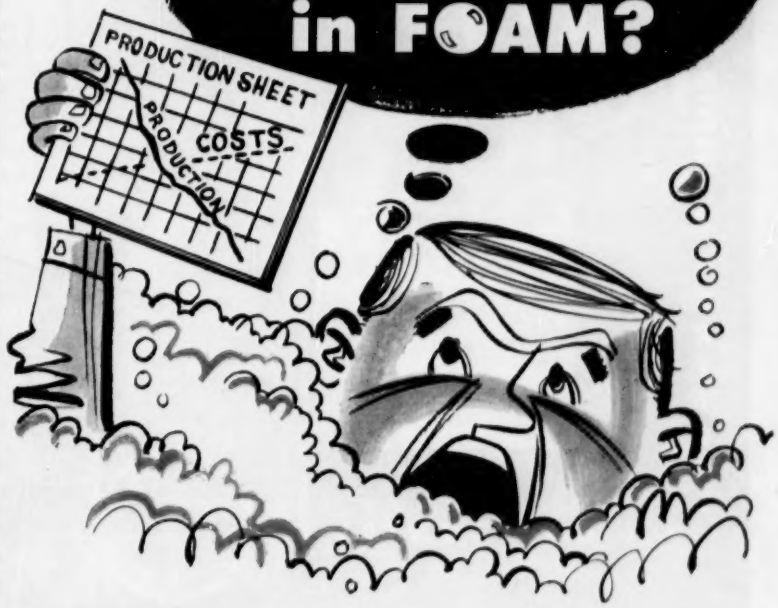
Write for NEW Abbé Jar Rolling Machine Catalog 79



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NAME

TITLE

COMPANY

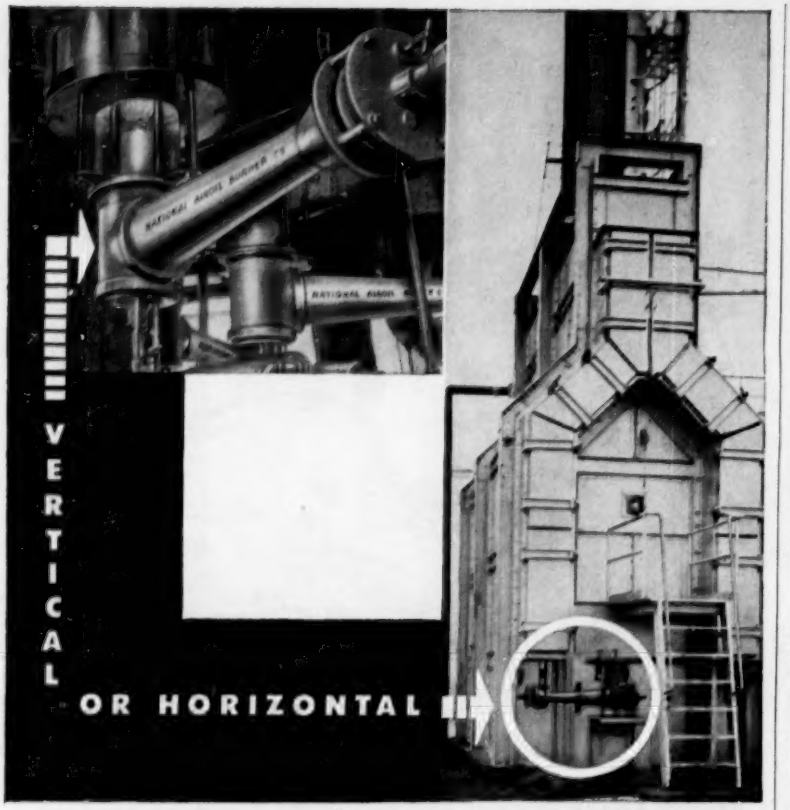
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My foamer is

Oil system

Aqueous system

Other



many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

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"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

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CHEMICAL-PETROLEUM DIVISION

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INCLUDES ALL THESE SCAM FEATURES:

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- **All relays mounted on plug-type jack . . . for maintenance just plug spare jack into housing!**
- **Only four holes required for easy panel mounting!**

For Constant Protection for ***Your*** *Monitoring Needs,* ***Choose a Scam Explosion Proof Annunciator.***

For special Explosion Proof Systems, consult with us or one of our representatives.

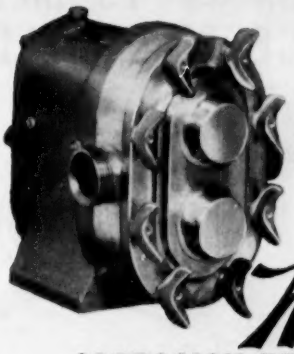
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Check this list of Design Benefits in

Waukesha

CORROSION RESISTANT PUMPS

. . . then clip and file





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WAUKESHA	OTHER
Perfect O-Ring sealing against product leakage or air intake *without* troublesome packing glands.	
Only corrosion-resistant non-abrasive *metal* impellors.	
Stainless steel positive drive shaft sleeve to save costly shaft wear.	
No small radius corners, short diameter grooves or dirt collecting, product contaminating corners.	
NO MATERIAL other than non-contaminating metal in contact with the product.	
A pump that meets 3-A Standards and the approval of the U. S. Public Health Service.	
A pump that provides side mounting.	
A pump that provides a vented cover to protect personnel and equipment against back pressure accidents.	

How is the score? WAUKESHA's ahead?

The features listed are but a few of the many you'll find in the new Corrosion Resistant Pump. They are all described and illustrated in the WAUKESHA Catalog — yours on request. Just send a postcard for Bulletin 1957.

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Waukesha

FOUNDRY COMPANY

Dept. U-10, Waukesha, Wisconsin

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Chemicals

Acids, Amino.....Fourth edition of "Proteins and Amino Acids in Animal Nutrition", 32 pages, contains information on the latest research in the amino acids field. Request a copy.
478Aa *U. S. Industrial Chem. Co.

Acid Chromic......"What Every User Should Know About Chromic Acid," 8 p., describes in detail the process of manufacture and discusses the problems involved in quality control. Request a copy.
502A Better Finishes & Coatings.

Acid Hydrofluoric.....12 p. booklet provides a comprehensive outline of the physical and chemical properties and uses of hydrofluoric acid. Includes charts on vapor pressure, boiling point.
502B .. ..Stauffer Chem. Co.

Acrylates.....You can improve your polymers with this company's higher acrylates. Bulletin F-7334, "Acrylic Esters" describes many known and potential uses for several acrylates.
175 *Union Carbide Chem. Co.

Adhesives....."Chemicals for Adhesives," 24 p., points out the usefulness and versatility of company's chemicals in adhesives via specific formulations for typical applications along with formulating method.
502C Neville Chemical Co.

Ammonia.....68 p. technical data book describes anhydrous ammonia and ammonia liquor, listing their chemical and physical properties, specifications, handling and storage features, unloading methods.
502D Allied Chem. & Dye Corp.

Anti-Adhesive, Silicone ..... Water emulsion and solvent solution of silicones imparting resistance to sticky materials described in two data sheets. Treatment may be applied to all paper-like materials.
502E Dow Corning Corp.

*From advertisement, this issue.

LITERATURE

Antioxidants.....“Analysis of Phenolic Antioxidants,” 16 p., describes analytical procedures available for analysis of phenolic food-grade antioxidants. Discusses reproducibility of test methods.
503A Eastman Chemical Prod.

Antioxidants.....Technical Bulletin ODB-57-31 describes company’s Santonox, an antioxidant for polyethylene. Tables and graphs give evidence of its performance characteristics in polyethylene.
503B Monsanto Chemical Co.

Calcium Carbonate.....“Low Sheen Flat Alkyd Wall Paints with Non-Fer-Al” summarizes in 6 p. principal advantages of company’s precipitaten calcium carbonate when used as an extender in dead flat paints.
503C Diamond Alkali Co.

Calcium Carbonates.....“Diamond Precipitated Calcium Carbonates for Polyvinyl Chloride Applications” reviews in 16 p. the use of eight chemicals as inert fillers for compounding PVC plastic products.
503D Diamond Alkali Co.

Caustic Soda.....Written for engineers, 40-page manual sums up the techniques for handling and storage of liquid caustic soda. Deals with equipment, safety precautions, first aid. Bul. 102.
392-31 *Hooker Electrochem. Co.

Chemicals.....Free adhesives formulae manual from company’s Technical Service Library. Booklet “Neville Chemicals for Adhesives”, shows sixty-six individual formulae, describes procedures.
105 *Neville Chemical Co.

Chemicals.....12-page bulletin, indexed for ready reference, has a complete listing of Hooker chemicals, and sums up the major types of processing performed at Hooker. Bulletin 100-A.
392-3m *Hooker Electrochem. Co.

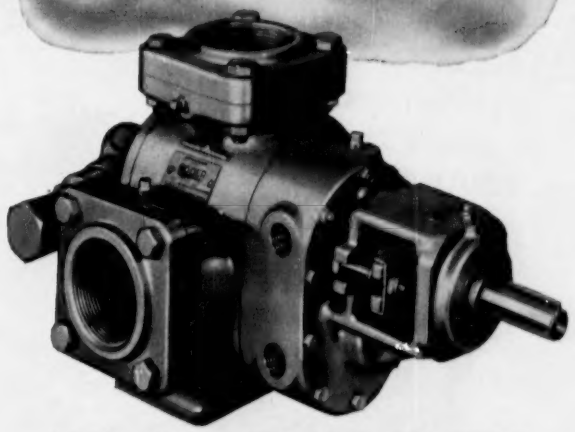
Chemicals.....16-page booklet lists all the many chemicals available to you from Harshaw, including electroplating salts, vinyl stabilizers, ceramic opacifiers and colors, fluorides, etc.
432 *Harshaw Chem. Co.

*From advertisement, this issue.

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NEW ROPER PUMP WITH STEAM CHEST



LOW COST METHOD OF HEAT TRANSFER TO PUMP AND PACKING

Capacities from 27 to 223 GPM
Pressures Up to 100 PSI

This is the same Roper Series 3600 Pump as found in general transfer installations, but with the added feature of a steam chest. A rotary gear unit, it is available with or without relief valve . . . also furnished with gear reduction, if desired.

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All Units Fitted with Aluminum Gaskets and High Temperature Packing

Steam Chest: Located between case and outboard bearing to transfer heat to both pump and packing. A low cost method for handling thick, viscous liquids. Can be used with steam, hot water, or heat transfer oil. Pump and steam chest static tested at 300 PSI. Recommended pressure with steam is 125 PSI.

- **Four ports in steam chest for installation convenience.**
- **Hardened gears and shaft precision ground; steel shaft induction hardened.**
- **Equipped with high temperature packing (600° F. max.) for effective sealing and long life. Pump fitted with aluminum gaskets.**

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Geo. D. Roper Corporation
460 Blackhawk Park Avenue
Rockford, Illinois

ROPER *Rotary Pumps*

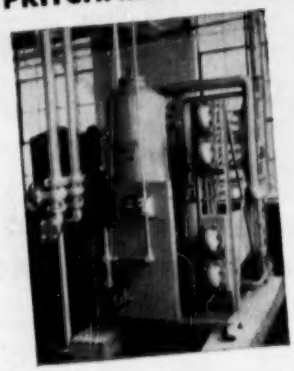
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this is what we need
and here's why



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- REDUCED EQUIPMENT AND LINE SIZES

. . . plus many other proved advantages.

Will you please send for this bulletin thanks Phil
their address is
J.F. PRITCHARD & COMPANY of CALIFORNIA
Dept. 593, 4625 Roanoke Parkway
Kansas City 12, Missouri

LITERATURE . . .

Chemicals, Agricultural.....Gibberellin, plant-growth stimulant, is now available in commercial quantities. Fosters faster germination, earlier flowering. Write for more information.
504A Velsicol Chemical Corp.

Chemicals, Organic . . . . . Data file folder contains technical bulletins describing in full detail 28 of the chemical products offered by the company. Includes up-to-date price list.
504B Benzol Products Co.

Chemicals, Organic.....8 p. brochure gives descriptive data on intermediates, plasticizers, gasoline additives, functional fluids, solvents. Information is presented in handy chart form.
504C Celanese Corp. of Amer.

Chlorinated Hydrocarbons Illustrated, 20 p. booklet describes the properties and uses of five compounds: typical analyses, solubilities, flash point and density tables and graphs.
504D Stauffer Chemical Co.

Detergent-Inhibitor.....14 p. illustrated report describes new type detergent-inhibitor called Paranox 302. Covers typical analyses, field evaluations, sludging studies.
504E Enjay Co.

Elastomers.....Company offers "The Du Pont Elastomers" (a review of the properties of neoprene and Hypalon) and "Elastomers Notebook" (contains articles based on the uses of Du Pont elastomers).
19 *Du Pont Co.

Emollient.....Ethylan, yellow lanolin products, finds use in lotions, lipsticks, hair lacquers and creams. Product bulletin 53 gives properties and describes use of this lanolin softener.
504F Robinson Wagner Co.

Emulsion, Polyvinyl Acetate.....7 p. bulletin PVB-521A describes company's Vinac WR-50, a new homopolymer. Includes recommendations for use in formulating trade sale and industrial paints.
504G Colton Chemical Co.

Emulsions, Polyvinyl Acetate.....12 p. manual describes company's line of polyvinyl acetate emulsions for textile finishing. Covers compounding and application techniques, typical formulations.
504H Shawinigan Resins Corp.

Hexanetriol.....8 p. Bulletin F-40,066 on 1, 2, 6-hexanetriol presents properties, shipping information, solubilities, performance data and applications. Material is in handy chart form.
504I Union Carbide Chem. Co.

Hydrocarbons.....Price list No. 12, 14 p., covers hydrocarbons and aliphatic sulfur compounds including paraffins, cycloparaffins, olefins, diolefins, cycloolefins, aromatics, mercaptans.
504J Phillips Petroleum Co.

Lithium Brines.....Lithium bromide and lithium cloride may be used in either direct contact absorption or refrigeration systems, as well as several other industrial applications. Data Sheets.
64-S *Lithium Corp. of Amer.

* From advertisement, this issue.

Lithium Hydride.....General properties, physical properties, uses of lithium hydride are covered in 4 p. Bulletin 102. Discusses its use as a source of hydrogen, catalyst, reducing agent.
505A Foote Mineral Co.

Lubricants....."Jet Age Lubricants" is a 24 p. manual on the development, testing and application of engineered lubricants. Charts show properties of company's synthetic lubricants vs. petroleum lubes.
505B Lehigh Chemical Co.

Magnesium Oxide.....International magnesium oxide is 99.0% pure, available in pellets and granular and powdered forms. There are many uses for this versatile material. Brochure.
405 *Internatl. Min. & Chem.

Mold Inhibitors.....4 p. brochure describes mold and rope inhibitors, calcium and sodium propionate. Includes typical analyses of the two inhibitors. Discusses use in bakery products.
505C Eastman Chemical Prods.

Organo-Aluminum Compounds..... Recently published technical data sheets hold information on four new organo-aluminum compounds now available from U. S. I. in pilot plant quantities.
478Ba *U. S. Industrial Chem. Co.

Paint Additive.....21 p. report on company's Nuozene, described as a self-sanitizing agent for paint. Discusses biological performance, methods of incorporation into latex paints and flat paints.
505D Heyden Newport Chem. Corp.

Paraformaldehyde.....Celanese paraformaldehyde is a free flowing solid, 91% available formaldehyde. High reactivity permits greater resin output, saves you a pretty penny. Technical Bulletin.
203 *Celanese Corp. of Amer.

Pentaerythritols....."Pentek, Its Uses In Resins for the Surface Coating Industry," 56 p., contains data on formulation and laboratory preparation of resins for the coatings industry.
505E Heyden Newport Chem. Co.

Pesticide Carrier.....Bulletin IPD-4-2, 4 p., describes Zeolex 7A, a hydrated silica used as a pesticide carrier for concentrates and wettable powders. Includes table of effects of surfactants on technical DDT.
505F J. M. Huber Corp.

Plastic, Polyvinyl Chloride.....Pipe, valves, fittings, sheets and rods made of Ryertex-Omicron PVC are discussed in PVC Bulletin 80-3, with information on properties, uses and handling.
232 *Joseph T. Ryerson & Son.

Plastic, Vinyl.....Development of vinyl plastic for silage protection is the subject of a 12 p. booklet, "A New Answer to an Old Problem." Various types of covers and their use are pictured and described.
505G Bakelite Co.

Plasticizers.....Technical bulletin No. 0-136, 6 p., on dicyclohexyl phthalate gives general properties, company specifications, resin compatibility, solvent compatibility, typical formulations.
505H Monsanto Chemical Co.

* From advertisement, this issue.

Young SAMPLE FLUID COOLER
chosen for use on new
ATOMIC SUB "SKATE"

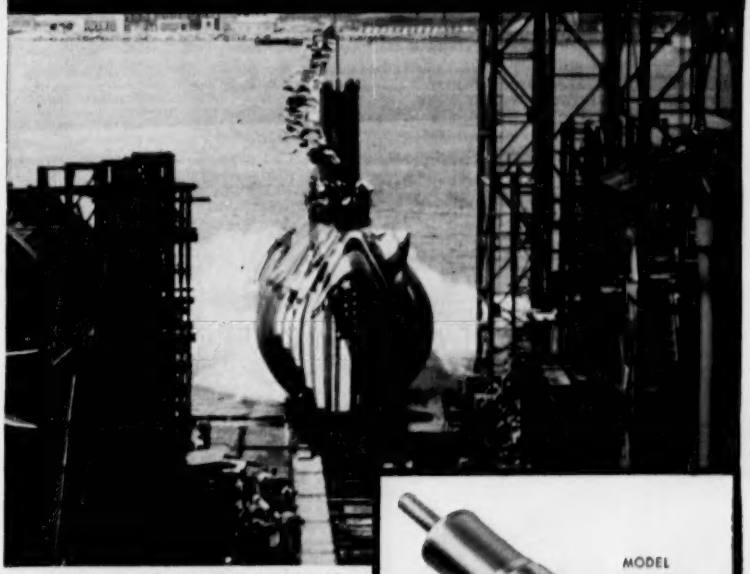


PHOTO COURTESY ELECTRIC BOAT DIVISION OF GENERAL DYNAMICS CORPORATION



Unit shown cools steam plant water from operating temperatures to 150° F.

Young shell and tubular coil sample fluid coolers will reduce temperatures from 600° F. to 100° F. at pressures up to 1,500 psi. These small, compact units cool sample fluids for control testing purposes for pilot plants, boiler water samples, chemical and other high temperature and pressure process fluids.



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Creative HEAT TRANSFER ENGINEERS
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Rotary AIRLOCK FEEDERS

for practically EVERY process requirement



STANDARD DUTY

For low pressure dust control systems where the pressure differential ranges from 0 to 12″ w.g. Available in 6″, 8″ and 10″ sizes—cast iron construction and rotors equipped with renewable wiper strips; with or without drives.

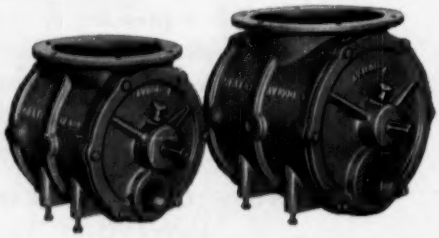


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For higher pressure dust control or pneumatic conveying systems where pressures may range up to 5 to 10 psi. Features life time lubricated sealed ball bearings and special shaft seals for heavy, continuous service. Built in 6″, 8″, 10″ and 12″ sizes; with or without drives.

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Ideal for feeding flour or any similar product into pneumatic conveying lines, against pressures up to 15 psi. Built in 8″ and 10″ sizes serving 2″ and 3″ conveying lines respectively. Available with or without drives.



Bulletin P-55 contains complete specifications and data—sent promptly upon request.

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Foremost Builder of Rotary Airlocks

PRATER PULVERIZER COMPANY

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LITERATURE . . .

Polyethylene.....“Factors Affecting Quality in Polyethylene Extrusion,” 31 p., by B. H. Maddock, contains sections on effect of screw design and operating conditions, control of mixing efficiency.
506A Bakelite Co.

Polyethylene Glycols.....2 p. bulletin gives use information, physical properties, specifications and shipping data on three of company’s polyethylene glycols: Poly-G 1000, 1500, B1530.
506B Olin Mathieson Chem. Co.

Polymers, Block.....“Pluoronics” are the first commercial examples of a block-polymer, 100% active in all forms, with many varied applications. Request a Pluronic Grid for performance predictions.
38-9 *Wyandotte Chemicals Co.

Polymers, Crystals, Plasmas.....An address by Guy Suits, GE director of research, discusses in layman’s terms frontiers in investigation of the elements in terms of polymers, crystals & plasmas.
506C Gen. Elec. Research Lab.

Polymers, Liquid.....“Liquid Polymer LP-31,” 8 p. covers a high molecular weight liquid polysulfide polymer used for sealing aircraft, other structures and machine components.
506D Thiokol Chem. Corp.

Refractories.....2 p. illustrated Bulletin 323 discusses properties and applications of company’s Tamax-EF super-refractories, recommended for severe service conditions.
506E Chas. Taylor Sons.

Resins, Thermoplastic.....12 p. booklet illustrates the unusual characteristics and applications of precision thermoplastic resin called Cycolac. Said to be ideal for molding, extruding, calendering.
506F Marbon Chemical.

Soda Ash.....Revised fourth edition of Soda Ash Bulletin, a standard reference for soda ash users the world over. Basic data on use, handling and storage of dry and slurry forms. Bulletin 5.
179 *Solvay Process Div.

Sodium Dispersions.....A completely revised 42 p. booklet is 50% larger than an earlier edition on the subject. Reactions, design and operating instructions for processing equipment in all size ranges.
506G U. S. Industrial Chem. Co.

Sodium Metasilicate.....Drymet anhydrous sodium metasilicate solves detergent compounding problems, puts more colloidal punch into cleaning compounds, lowers costs, gives pH control. Folder.
T550 *Cowles Chem. Co.

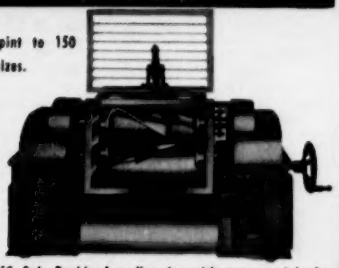
Tapioca Flour.....Laboratory report A-810-M1 deals with the nature and uses of tapioca flour, said to be the world’s most important noncereal starch. Describes derivation, manufacture, properties.
506H Morningstar, Nicol, Inc.

Thiosemicarbazide.....A reactive compound which behaves as a monoacid base and is a strong reducing agent is described in a new 4 p. bulletin. Includes properties, typical reactions, uses.
506I Olin Mathieson Chem. Co.

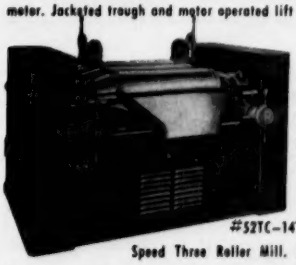
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Leading mfrs. of
MIXING AND GRINDING EQUIPMENT
for over 90 years

• 1 pint to 150 gal. sizes.



#41L–10 Gal. Double Arm Kneader with two speed brake motor. Jacketed trough and motor operated lift optional.



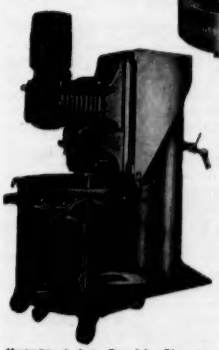
• 4½ x 10, 6 x 14, 9 x 24, 12 x 30, 14 x 32, 16 x 40″ sizes.

#52TC–14″ x 32″ High Speed Three Roller Mill. Hydraulic adjustment and pressure recording gauges optional.

#30C–50 Gal. Heavy Duty Change Can Mixer. Adjustable outer scraper, cover with charging port, and gates on cans optional.



• 8, 16, 20, 50 and 60 gal. sizes.



#130H–250 Gal. Change Tank Mixer with hydraulic raising and lowering and variable speed motor. Various type stirrers and high speed impellers optional.

• 80,150 and 250 gal. sizes.

#130EL–1 Gal. Double Planetary type Change Can Mixer with shearing action stirrers, and variable speed reversing type motor. Jacketed cans and portable trucks for cans optional.

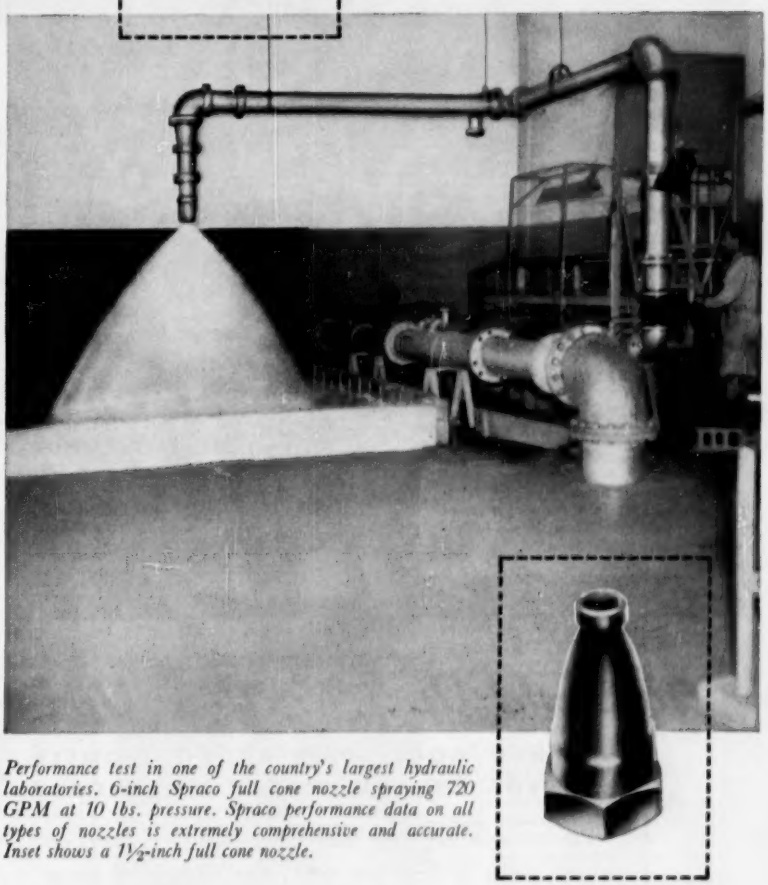


• 1, 2, 3, 4, 6, 15, 25, 50, 65, 85, 110 and 150 gal. sizes.

Write for complete information on these or other types of equipment.

CHARLES ROSS & SON COMPANY, INC.
150 CLASSON AVENUE
BROOKLYN 5, NEW YORK

SPRACO nozzles



Performance test in one of the country's largest hydraulic laboratories. 6-inch Spraco full cone nozzle spraying 720 GPM at 10 lbs. pressure. Spraco performance data on all types of nozzles is extremely comprehensive and accurate. Inset shows a 1½-inch full cone nozzle.

SPRACO
full cone spray nozzles

IN STOCK — the most complete range of sizes and capacities available anywhere.

IN BRASS, BRONZE, STAINLESS STEEL, or (on special order) in any machineable metal.

PATTERN — uniform, even distribution, — wide angle down to sharp angle.

REPLACEABLE CORE — in spraying highly corrosive liquids at high pressures worn cores are easily replaced.

FLAT SPRAY and HOLLOW CONE SPRAY nozzles are also available from stock.

Write, or phone (Boston, SOmerset 6-5480)
SPRAY ENGINEERING COMPANY
15 Cambridge St., Burlington, Mass.

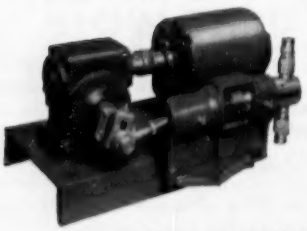


Scale deposits on steam turbine blading. Photo courtesy of Hartford Steam Boiler Inspection & Insurance Co.

No Build-Up! No Blow-Up!

. . . WHEN MODEL 1106 PROPORTIONEER FEEDS BOILER WATER CHEMICALS

Prevent scale build-up (caused by boiler carry-over) on turbine blades with proper raw water or internal steam boiler treatment. Model 1106 Proportioneer feeds all chemicals (alkaline, neutral, or acid) accurately (guaranteed within ±1%) over 15 to 1 range. Capacities range from 0.11 to 35.6 GPH . . . for discharge pressures up to 1100 psig.



PAY LESS, GET MORE!

Design features of this proportioning pump include interchangeable measuring cylinders, super-accurate Vane-Guide check valves, and percentage calibrated stroke-length scale.

Request Bulletin 1106-2 for complete data. Write to PROPORTIONEERS, INC., 369 Harris Avenue, Providence 1, Rhode Island.

PROPORTIONEERS, INC.
DIVISION OF
B-I-F INDUSTRIES
PROVIDENCE, RHODE ISLAND
METERS FEEDERS CONTROLS

LITERATURE . . .

Urethanes.....16 p. booklet discusses foams, hard or soft, flexible foams, soft foam applications, rigid foams, protective coatings, textile finishing, adhesives, solid rubber. Illustrated.
508A Allied Chem. & Dye Co.

Vinyls, Non-Rigid . . . . . "The Non-Rigid Vinyl Story," 20 p., consists of illustrated case histories which give a description of vinyl elastomeric compounds and the variety of applications they have found.
508B Bakelite Co.

Yttrium & Rare Earth Oxides..... This company is now shipping high purity yttrium and rare earth oxides in quantities from a gram to hundreds of pounds. "Purified Rare Earth & Yttrium Oxides."
442 *Lindsay Chem. Co.

Construction Materials

Alloys, Titanium Carbide.....Heat resistant titanium carbide alloys and their many applications in chemical and other industrial equipment are presented in illustrated Bulletin B-444.
508C Kennametal, Inc.

Aluminum.....Solve your corrosion problems in the process industries by reading Process Industries Applications of Alcoa Aluminum. Its 80 pages are filled with details. Bulletin AD460.
32C *Aluminum Co. of Amer.

Cable, Armored.....Armortube cable consists of multiple copper or aluminum tubes in a single flexible armored cable. Product Specification and Price List G91-9 contain details.
378 *Bailey Meter Co.

Castings.....Whether the castings you need are classified as usual or unusual, Kutztown castings can be proved to be accurately and economical produced. Ask for "Kutztown Review".
B547 *Kutztown Mach. & Fdry.

Castings, Stainless Steel . . . . . "A-L Stainless Castings" has 28 pages of valuable and complete data on analyses, properties, handling and heat treatment, typical uses of stainless steel castings.
434 *Allegheny-Ludlum Steel.

Coatings, Antiseptic.....An antiseptic coating material can be applied to objects which are handled by the public but seldom washed. Applied by dipping, spraying or brushing. TD 1271.
478Bc *U. S. Industrial Chem. Co.

Coatings, Neoprene.....New data sheet available listing physical and chemical resistance of Neoprene sheet. Bulletin 7 comes from an experienced applicator of protective coatings.
508D Metalweld Inc.

Coatings, Protective . . . . . Illustrated Catalog describes Amercoat protective coating systems for corrosion control. Outlines corrosion control services: assistance in selection, help write specifications, etc.
508E Amercoat Corp.

* From advertisement, this issue.

Coating, Vinyl Mastic.....Amercoat No. 87, a vinyl mastic coating, combines the chemical and weather resistance of vinyl coatings with the thickness of mastic, yet is easily sprayed. Information.
321 *Amercoat Corp.

Conduit, Aluminum.....Company offers literature on Alcoa Aluminum Electrical Rigid Conduit, which is used in refineries, chemical plants, and other buildings in the chemical process industry.
79 *Aluminum Co. of Amer.

Fabrication.....Plant Survey Report No. 4 is a comprehensive description of Nooter facilities for plate fabrication and erection. Company pledges careful field erection and inspection.
161 *Nooter Corp.

Fabrication, Metal.....This company produced the first two-region breeding homogeneous reactor, a pressure vessel constructed from zircaloy-2. Illustrated booklet, "Facilities and Products".
128 *Newport News Shipbuilding.

Fabrications, Plastic.....Custom built corrosion resistant and non-contaminating plastic fabrications, Agilene and Agilide, are chemically inert, strong, light weight, impact resistant. Bul.
R531 *American Agile.

Fabrication, Welded.....Baldwin-Lima-Hamilton's high performance welding for industry is illustrated inits free Bulletin 7001. Qualified welders, radiographic inspection.
100 *Baldwin-Lima-Hamilton.

Famricators, Heat Exchangers..... Whitlock designs and manufacturers not only the standard sizes and types of Heat exchangers, but also special exchangers for varied services. Bulletin 250.
126 *Whitlock Mfg. Co.

Felts, Armalon.....Armalon is the felted form of Teflon tetrafluorine resin, available in one construction for filtering and another impregnated for gasketing. "Armalon" Booklet.
388 *Du Pont Co.

Fencing, Aluminum.....Fenced areas require no preventive maintenance with aluminum chain link fencing, which resists corrosion in the most active industrial atmospheres. Four-color brochure.
316-7d *Reynolds Metals Co.

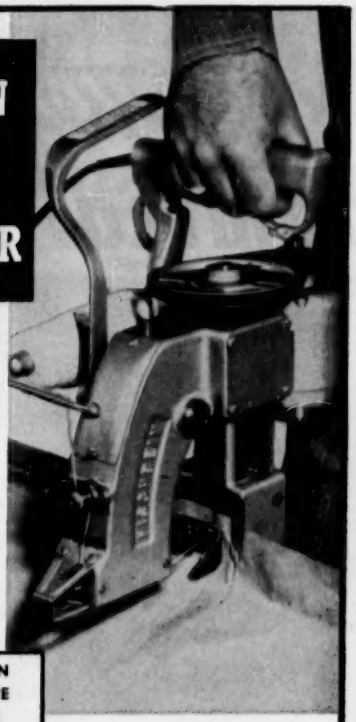
Grating, Steel.....Increase feeder and storage areas in your plant with Blaw-Knox's electroforged steel grating. Fabricated to meet your own specifications. Send for Bulletin 2527.
74 *Blaw-Knox Co.

Insulating Brick.....Use of Harbison-Walker insulating fire brick provides savings in fuel, time, space and weight in insulated furnaces. Seven types available. Data in H/W Bulletin.
306-7
*Harbison/Walker Refractories.

Insulation, Pipe.....Single-layer Unibestos pipe insulation locks in more heat than most double-layer insulation. Resists shock, vibration and fumes. Exclusive "J" Factor Tables in 40 p. Bul.
108 ***Union Asbestos & Rubber.**

* From advertisement, this issue.

FISCHBEIN
Portable
BAG CLOSER



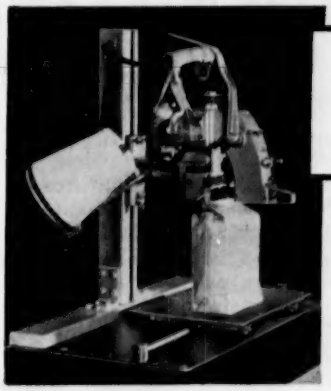
HANDLES ALL TYPES OF BAGS!

- Total weight. 10½ lbs.
- Requires no installation . . . plug into any outlet
- Simple to operate and maintain
- Lowest priced bag closer on market

FULLY GUARANTEED!

OPTIONAL SUSPENSION UNIT ADAPTS MACHINE TO STATIONARY USE

NEW! FOR CLOSING SMALL BAGS!



FISCHBEIN TABLE MODEL CARRIAGE CONVEYOR
(Model FS)

One simple knob locks any Fischbein Portable Bag Closer into proper sewing position. Carriage slides freely and returns automatically to starting position, ready for next bag.

UNIQUE VERSATILITY! Any Fischbein Bag Closer can be used 3 different ways!

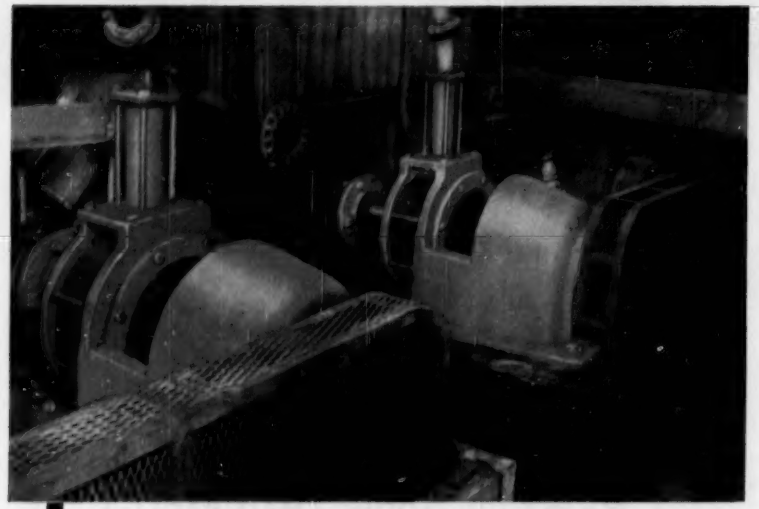
1. Completely portable
2. Suspended with counterbalance
3. On carriage conveyor for closing small bags

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Firm Name_____
Address_____
City_____ Zone____ State_____

Imperwite IMPERVIOUS GRAPHITE Chemical Pumps

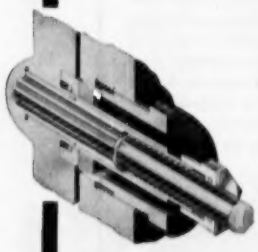


...REDUCE COSTS at Durez Plastics Division Hooker Electrochemical Co.

Fourteen IMPERVITE chemical pumps are in operation at the North Tonawanda plant, handling hot mixtures of phenol, chlorobenzene, and benzene as well as hot and cold muriatic.

Under conditions of continuous operation, these pumps may run for months with no maintenance other than an occasional adjustment of the seal adjusting nut.

Mr. Littler, Maintenance Engineer for this plant, states, "Over the past 3 months, the total expense for material and labor on *all* of these IMPERVITE pumps was only $23.00."



VIRTUALLY LEAK PROOF IMPERVITE PUMP SEAL

IMPERVITE chemical pumps are single stage centrifugals, and utilize a new self-cooling and self-lubricating seal which is virtually leakproof. Six standard models are available from stock, and specials are furnished in capacities to 1000 gpm.



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PHONE: CHurchill 8-5357
TELETYPE: SOLON 0-720
31915 AURORA ROAD • SOLON, OHIO

LITERATURE . . .

Jacketing, Aluminum.....40 p. manual, "Kaiser Aluminum Insulation Jacketing Materials and Methods", discusses advantages, relative costs, recommended materials and specifications of aluminum jackets.
182-3 *Kaiser Alum. & Chem. Sales.

Linings, Protective.....Pre-vulcanized Fairprene sheet stock is made for protective lining which offers outstanding resistance to harsh chemicals, ozone, oxidation, aging and abrasion. Bklet.
454 *Du Pont Co.

Linings, Rubber.....Manhattan acid proof rubber tank linings are made from thick multiple calendered sheets of natural or synthetic rubber and securely bonded to the metal. Catalog #7115.
396 *Raybestos-Manhattan.

Metal, Tungsten Carbide.....Talide metal is harder, stronger and more resistant to abrasion than any other metal. It wear-proofs vital parts of processing equipment. Catalog 56-G.
424 *Metal Carbides Corp.

Plastic Steel.....Using Devcon plastic steel, 80% steel and 20% plastic, you can make spot repairs on storage tanks, piping, pumps and valves without shutdown. Write for booklet about 1001 uses.
L540 *Devcon Corp.

Porcelain, Chemical.....Lapp Chemical porcelain can usually be fabricated to your specifications for sleeves, nozzles, tubes, pipes and fittings, plates, grates, etc. Description & specs.
303 *Lapp Insulator Co.

Refractories.....Company offers three booklets—the current issue of Refractories magazine, reprint of a February, 1957, article in Product Engineering article and a bulletin on "Refrax".
211 *Carborundum Co.

Resin Sheets, Porous.....For information on Armalon fibrous sheets, consult products Bulletin No. 6. New class of products consist of Teflon resin in the form of fibrous sheets for filtration, etc.
510A Du Pont Co.

Rubber & Plastic Materials.....Eleven job-proved rubber and plastic materials are now available in Ace piping, valves, pumps and tanks. Discussed in comparative properties Bul. CE-50.
353C *American Hard Rubber

Sheet, Aluminum.....Requires little maintenance, easily installed, and low-costing. Booklets tell the story—write for Painting With Aluminum (AD228), Sandwich Walls (AD625, and Industrial Building AD285).
31b *Aluminum Co. of Amer.

Steel, Stainless.....Detailed information about Type 430 nickel-free straight chromium stainless steel is found in new 28-page booklet. Includes physical properties and analysis, corrosion resistance.
510B Washington Steel Corp.

Stair Treads, Aluminum.....New grating-type Alcoa aluminum stair treads require no paint. Available in all standard sizes. Extra nonskid protection with bonded abrasive surface. Write for Bulletin AD596.
32b Aluminum Co. of Amer.

*From advertisement, this issue.

Steels, Clad.....Lukens clad steel is a solid steel plate, one side corrosion resistant metal permanently bonded over-all to a rugged, economical steel backing. "Clad Steel Equipment" bklet.
406 *Lukens Steel Co.

Steels, Stainless.....When you count the cost of corrosion, stainless steel reactor vessels cost less. Corrosion resistant stainless steel can be formed into almost any shape. Bulletin offered.
305 *Crucible Steel Co.

Steels, Stainless.....Armco 17-4 PH stainless steel is available in bar, wire and billets—Armco 17-7 in strip, sheet, plate, bar and wire. "Armco Precipitation - Hardening Stainless Steels" Cat.
413 *Armco Steel Corp.

Tantalum.....Company offers a corrosion test kit containing both tantalum sheet and wire, and their publication, "Corrosionomics". Tantalum is noted for its resistance to corrosives.
R535 *Fansteel Metallurgical.

Teflon, Cementable.....Cementable Teflon, Garlock No. 8536, with one side treated and ready for application to and metal, wood, glass, concrete, or plastic surface, is offered. Bul. AD-158.
361 *U. S. Gasket Co.

Teflon Shapes.....Indexed brochure, "Teflon Shapes", describes sheets, rods, tubes, joints, bellows, gaskets and tape molded from virgin Teflon. Drawings, specifications and photographs are included.
90a John L. Dore Co.

Titanium.....Titanium is now readily available for non-defense uses; standard parts can be made to specifications. Titanium equipment is solving severe corrosion problems. Titanium Booklet.
326-7 *Du Pont Co.

Titanium.....The Rem-Cru Review, a free periodical presenting the latest data on titanium, is available to you on request. Titanium weighs only 56% as much as steel, outlasts most metals.
461 *Rem-Cru Titanium.

Zirconium.....Metallurgically sound zirconium ingots are being produced in quantity by the world's first fully integrated zirconium plants, to meet your most exacting needs. "More ZR Facts."
66-7 *Carborundum Metals Co.

Zirconium.....Technical digest on commercial-grade zirconium features uses, corrosion resistance data, fabrication techniques, and physical and mechanical properties. Send for your copy now.
87 *Columbia-National Corp.

Electrical & Mechanical

Bolts, Self-Locking.....According to new 4-page folder, Nylok self-locking bolts solve fastening problems involving adjustment, liquid sealing and vibration without extra locking devices or wiring.
511B Republic Steel Corp.

* From advertisement, this issue.

FLETCHER TORNADO

THE CENTRIFUGAL WITH FULL AUTOMATION



CUT PRODUCTION COSTS IN HALF — The Fletcher Tornado needs no operators. It's fully automatic, gives you 24-hour production. You're certain of quality control of your product because of the uniform load and the unvarying consistency. Compare these features.

Uni-Construction—Entire centrifugal—basket, curb, drive and accessories oscillate as a unit.

Bi-Ball Swivel — Dual ball and socket on each of the three steel balancing stands assure smooth oscillation.

Tri-Point Suspension—Scientifically positioned to provide positive, effortless balance of the entire centrifugal.

Also available in manual and semi-automatic models.
F/M variable drive • Zero to maximum RPM

The **New** *Fletcher Works, Inc.* CENTRIFUGAL DIVISION

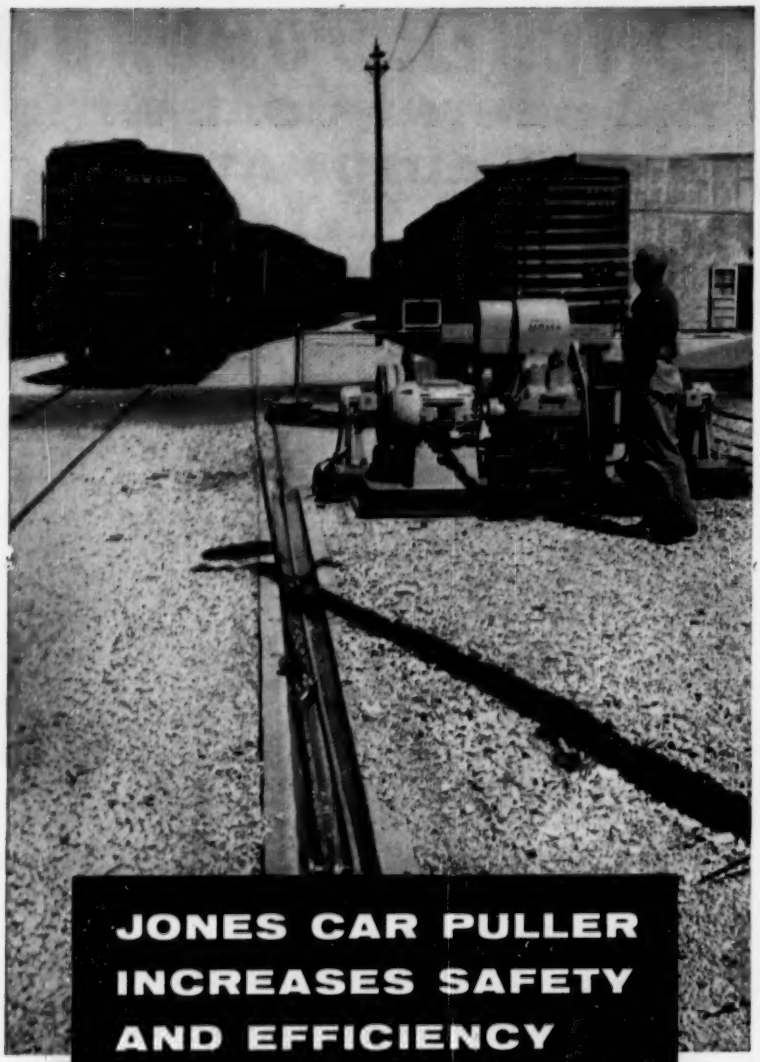
2nd & Glenwood Avenue • Philadelphia 40, Pa.

Send me additional information on the Fletcher Tornado Centrifugal

NAME & TITLE

COMPANY

ADDRESS CITY & STATE



JONES CAR PULLER INCREASES SAFETY AND EFFICIENCY

This Jones two-way car puller has materially increased freight handling efficiency at Corn Products Refining Company's Pekin, Illinois, plant. To move cars on either siding, the operator merely hooks a cable to one of the cars and pushes a button on the control panel. Only a small part of one man's productive time is needed, and the system is both safer and faster than former methods.

The Jones car puller is but one of the many types of Hewitt-Robins equipment for helping industry solve its bulk materials handling problems. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut.

HEWITT-ROBINS

CONVEYOR BELTING AND IDLERS . . . POWER TRANSMISSION DRIVES
INDUSTRIAL HOSE . . . VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

LITERATURE . . .

Bus Bars, Aluminum.....Alcoa Bus Conductor Handbook AD661 describes advantages of this aluminum product—good corrosion resistance and lowest cost per unit current capacity.
32a *Aluminum Co. of Amer.

Closures, Protective....Complete specifications for both rubber and plastic closures are found in a new 4-page catalog. Devices protect, seal or mask threaded parts, pipe ends or tubing.
512A Shurclose Seal Co.

Combustion Units.....Vertical or horizontal oil-gas tandem combustion units provide many more hours on stream without forced shutdown; high fuel economy. Write for Bulletin 498 now.
500 *Nat'l. Airoil Burner Co.

Connectors & Panels, Thermocouple.....You can transfer any number of thermocouples with T-E connector panels and quick-coupling connectors. Available in many sizes and shapes. Bulletin 23E.
BR539 *Thermo Electric Co.

Couplings.....Kamlok coupling assemblies couple and uncouple instantly regardless of "hook-up". Just slip adapter into coupler and close cam arm—no tools needed. Write for Bul. F-10R.
18 *Jordan Corp.

Drives, Agitator.....Recently announced Bulletin 951 tells about new type W drive for agitators that features wide range of speed and power. Also available with hydraulic drive for hazardous locations.
512B Pfaudler Co.

Drives, Dry Fluid.....New Bulletin A654 discloses new larger Flexidyne dry fluid drives for use with motors up to 75 hp. at 1,750 rpm. Motor sizes are listed that can be used with the new drive.
512C Dodge Mfg. Corp.

Drives, Hydraulic Fan.....Hydraulic fan drives for air cooled heat exchangers and cooling towers save power and assure accurate, flexible, dependable operation according to Bulletin 3009.
512D De Laval Steam Turbine.

Drives, Motor.....Sizes 200-300 Vari-Speed Motodrives are complete variable speed power packages, built with compact precision. Details, illustrations, prices in Cat. CE31a-M571.
44-5 *Reeves Pulley Co.

Drives, Roller Bearings & V-Belts..... Bulletin A-640-A describes Flexidyne dry fluid drives and couplings, Bulletin A-638 describes roller bearings, Bulletin A-606-A describes sealed-life V-belts.
339 *Dodge Mfg. Co.

Drives, Stock.....Folder 2642 provides an easy reference for selecting stock drives. Selection charts cover line of gearmotors, motor-gears, worm-gear drives, variable-speed and other gear drives.
512E Link-Belt Co.

Drives, Variable Speed.....Included in new Catalog M-571 you will find complete rating, dimensional, accessory and modification information on the Reeves line of new 200 and 300 Motodrives, 1-5 hp.
512F Reeves Pulley Co.

*From advertisement, this issue.



any surface temperature with Alnor® PYROCON

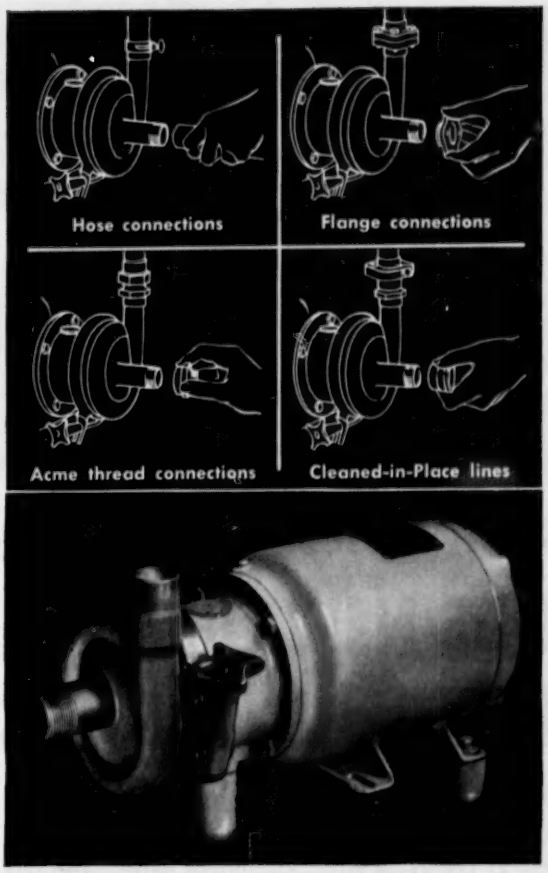
Equipment...material...metallic or non-metallic...flat, curved... revolving or stationary—you can read its surface temperature accurately in less than 3 seconds!

Compact in size, complete in precision design and workmanship, this rugged instrument assures the highest standards of speed, accuracy and dependability. Heavy-duty, shock-resisting movement is housed in a balanced unit that is easy to handle...reaches any point.

Alnor Portable Pyrocons come in scale ranges to 2000° F., with thermocouples for every application. You'll find full details on the Pyrocon exactly suited to your operations in Bulletin 4257. Send for your copy now. Write: Illinois Testing Laboratories, Inc., Room 559, 420 N. LaSalle St., Chicago 10, Illinois.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY



Standard with I.P.S. connections.

New CHERRY-BURRELL Vapor Blast Finish 316 Stainless Steel Pumps

As shown above, you can connect new Cherry-Burrell foamless "Flexflo" Centrifugals in any of 5 different ways. In addition, you position adjustable outlet to fit any pipeline setup.

Should you want to clean or inspect any of the corrosion-resistant Type 316 fortified stainless steel contact surfaces, you disassemble pump in 30 seconds—reassemble in 60—all without tools.

Other Flexflo Features

Low Operating Costs: Body design assures full flow discharge with low friction loss, reduced power.

Positive Sealing with less pressure, less wear.

Capacity Range: From 2000 lb./hr. to 100,000 lb./hr. and heads up to 120 ft.; ¾ to 10 h.p. motors.

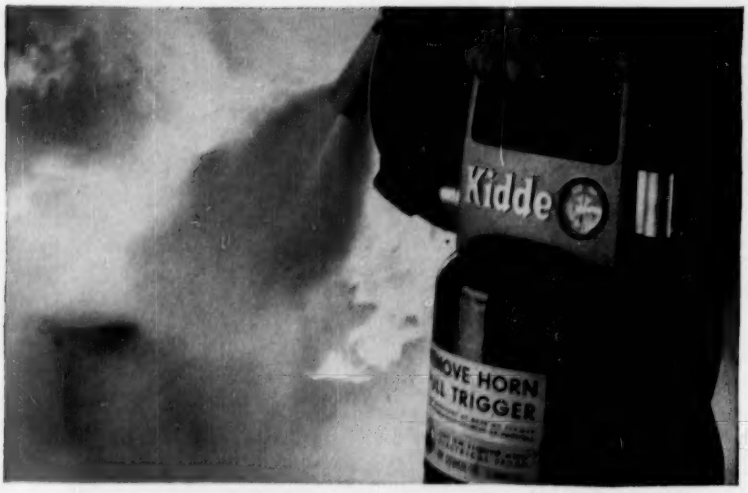
Ask your Cherry-Burrell Representative for further Flexflo details. Or write for literature.

CHERRY-BURRELL CORPORATION

427 W. Randolph Street, Chicago 6, Ill.

Dairy • Food • Farm • Beverage • Brewing • Chemical-Equipment and Supplies

SALES AND SERVICE IN 58 CITIES—U.S. AND CANADA



Easiest, fastest way to kill fire...

KIDDE NEW DRY CHEMICAL EXTINGUISHER

Here – from Kidde – is the newest, the fastest, the easiest-to-operate dry chemical fire extinguisher!

Look at the extra large, aluminum handle and trigger – even a gloved hand fits comfortably with room to spare. Pick the unit up – it hangs straight – no awkward angle to throw you off balance.

If fire strikes, follow the simple directions: "Remove Horn" – automatically the trigger safety lock is released – "Pull Trigger" – instantly a cloud of fire-killing dry chemical whooshes out of the nozzle and fire's out! With this unit, designed by Kidde engineers working with Henry Dreyfuss personnel, you don't have to be a trained fireman to get perfect results.

Built for a lifetime of use, the handsome, new 20 and 30 pound Kidde dry chemical extinguishers have top ratings from Underwriters' Laboratories, require only 225-250 psi charging pressure. The rugged pressure gauge is recessed in handle for maximum protection. Tells at a glance if the unit is ready for use.

Available nationally through Kidde's sales and service organization. Write Kidde today for the name of nearest distributor.



Kidde (K Kidde)

Walter Kidde & Company, Inc.
1028 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd., Montreal—Toronto

LITERATURE . . .

Gaskets, Teflon.....A complete line of gaskets, back-up rings and O-rings described in Bulletin P-327 are fabricated from Teflon. Data includes operating pressures, sizes, dimensional details.
514A Crane Packing Co.

Gaskets, Teflon Jacketed.....Chemiseal gaskets with Teflon protecting jackets are impervious to practically all known chemicals. Made with several filler constructions. Catalog AD-145.
345 *U. S. Gasket Co.

Headers, Pivot.....On water, sewage and waste treatment installations, new pivot headers permit the easy removal of selected sections of aeration systems. Diffuser assembly can be raised for inspection.
514B Walker Process Equipment.

Motor Controls.....Allen-Bradley line comprises hundreds of standard motor controls designed for specific jobs. Company offers the 132-page Handy Catalog, filled with motor control data.
422 *Allen-Bradley Co.

Motor Starter Enclosure.....Bulletin 9990 presents details on a new explosion-resisting motor starter enclosure for NEMA 7 (Class 1 Groups C and D) and NEMA 9 (Class 2 Groups E, F, G).
514C Square D Co.

Motors.....Reduce down time and power your equipment with Wagner Motors complete line of integral and fractional horsepower motors. Send for Bul. MU-185 for more information.
101 *Wagner Electric Corp.

Motors.....Company will work closely with you to provide the right motor, at the right time, at the right price. Consolidated Catalog and Price List No. CE-10 3540 are available on request.
127 *Diehl Mfg. Co.

Motors.....Bulletin entitled "Where Low Starting Current is Required" shows why special low-current starting costs less when you specify Century part winding start motors. Free.
395 *Century Electric Co.

Motors.....Type H Uniclosed motors have asbestos insulation against heat and moisture, baffles to direct air and deflect moisture, rugged cast iron frame and other exclusive features. Bul. F-1856.
409 *U. S. Electrical Motors.

Motors, Electric.....Marathon offers their complete condensed catalog with information on their line of chemical motors as well as their line of explosion proof motors. Yours for the asking.
379 *Marathon Electric Co.

Motors, Electric.....Company manufactures a complete line of motors to the new NEMA standards and features special motors to meet the widely varied requirements of industry. See Bulletin 1700.
514D Louis Allis Co.

Motors, Explosion Proof.....You need tough-shelled, explosion-proof motors in the corrosive, volatile atmospheres of many modern chemical processing plants. Large motors shown in Bul. 800.
398 *Louis Allis Co.

*From advertisement, this issue.

Motors, Pump.....Totally protected P-Base motors have weather tight construction, perfect pump seating, lifelong bearing protection, enclosures for every application. Request Bulletin B-2502.
107 *Reliance Elec. & Eng.

Packing, Goodloe Column.....Made of knitted wire strands, Goodloe packing approaches the vapor or gas-liquid contacting effectiveness of Stedman's packing with capacity of bubble tray, reports Bulletin.
515A Packed Column Corp.

Packing, Panapak Column.....According to new technical bulletin, Panapak packing offers high capacity and improved gas-liquid contacting. Tables present operating data for your evaluation.
515B Packed Column Corp.

Packings, Plastic.....Versi-pak is a nonjacketed plastic packing made of selected asbestos fibers in combination with special binding materials and lubricants. Write for "Plastic Packings" booklet.
358 *Raybestos-Manhattan

Packing, Stedman Tower.....Detailed technical bulletin presents complete description and data on the conical type, wire cloth packing which takes only ⅛ to 1/10 the height of equivalent bubble trays.
515C Packed Column Corp.

Packings, Teflon.....Lattice-Braid packings made of Teflon reduce process shutdowns, lower replacement costs, reduce wear on pistons and shafts, and increase productive capacity. Catalog AD 131.
429 *Garlock Packing Co.

Packings, Teflon.....Champro Teflon packings last for many months under corrosive conditions that destroy conventional packings in days or even hours. Full details available in Bulletin CP552.
R541 *Chem. & Power Products.

Pillow Blocks.....8-page Bulletin A-668 describes Spher-Align pillow blocks. Photographs, engineering dwgs. and tabulated data on dimensions, shaft sizes, weights and radial load ratings.
515D Dodge Mfg. Co.

Reactor Systems, Nuclear Power..... Reactor systems to produce commercially useful electricity from nuclear energy are reviewed in Bulletin GER-1384. Based on lecture study presented in Europe.
515E General Electric Co.

Regulators & Rectifiers.....Company offers technical bulletins on their regulators for electric arc furnaces and power generating equipment, and on pumpless steel tank rectifiers.
479 *Secheron Works.

Rings, Raschig.....Raschig rings are available in chemical stoneware and porcelain, in carbon and metal. Complete data on all company's packing materials offered in Tower Packing Catalog.
134 *U. S. Stoneware Co.

Seals.....If you have a sealing ring problem that demands extreme resistance to abrasion, the ability to resist high temperatures or unusual corrosion resistance, write for "Characteristics" book.
515 *Kennametal Inc.

*From advertisement, this issue.



If you have any sealing ring problem that demands . . .

1. Extreme resistance to abrasion, or

2. The ability to resist elevated temperatures, or

3. Unusual resistance to severe corrosion.

KENNAMETAL has some proven answers for you.

ABRASION RESISTANCE. Kennametal tungsten carbide sealing rings installed in a deep-well rotary pump gave one to two years' service; packing type seals had failed in two to four weeks. Kennametal rings in a recirculating pump, handling water with fine grains of iron oxide, lasted 30 to 60 *days*. Packing type seals failed in 24 to 48 *hours*.

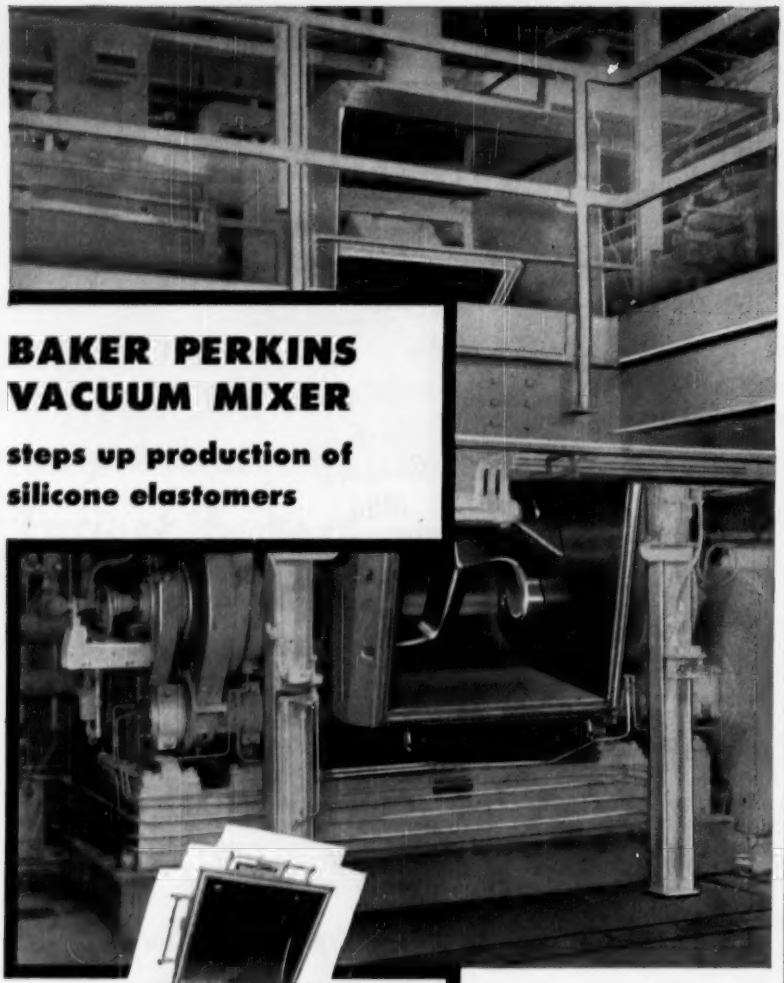
ELEVATED TEMPERATURES. A jet engine shaft seal of Kentanium,* a titanium carbide, operating without lubrication at 15,000 surface feet per minute under 0.3 to 0.6 lbs. pressure per lineal inch of circumference and 900° to 1000° F, outperformed every other material. Kentanium Rings are stress-free—do not tend to split radially, maintain original face flatness even at high temperatures, and have exceptional wear and resistance strength.

SEVERE CORROSION. Where corrosion and abrasion are present, Kennametal has seal rings of Grade K501, a platinum-bonded carbide. Used as seals to confine liquid oxygen or fuming nitric acid, sealing results are reported as "far superior to any previously used materials, with no indication of face wear."

Other desirable characteristics of Kennametal seals: high modulus of elasticity, low expansion under heat, high resistance to wear and much lower service cost. For more information, ask for "Characteristics" book, write KENNAMETAL INC., Latrobe, Pennsylvania, Dept. CE.

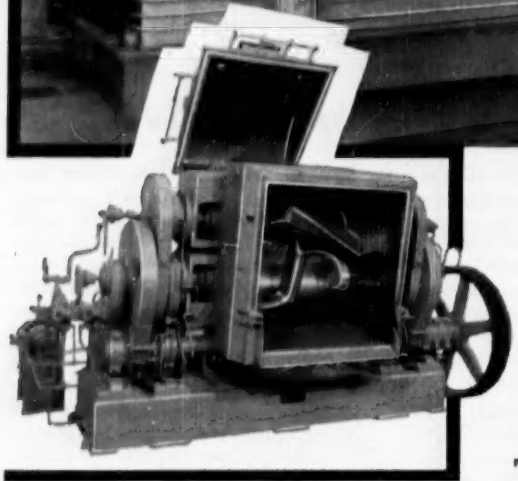
*Kennametal and Kentanium are the trademarks of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum. C-9070

INDUSTRY AND
KENNAMETAL
...Partners in Progress



BAKER PERKINS VACUUM MIXER

steps up production of silicone elastomers



• General Electric Company's Silicone Products Department is using this Size 18 Baker Perkins Mixer in the production of silicone elastomers at its modern plant in Waterford, New York.

The size 18JWUMM2 B. P. Mixer was designed specifically to meet this customer's exact mixing requirements. It is a big, heavy duty unit, that was built to the same high standards of materials and workmanship that have made Baker Perkins the leader in the mixer field for over 64 years.

The same, dependable *Baker Perkins* vacuum mixers which have given unfailing service in such processes as compounding paints, rocket fuel and plastics, are finding immediate and enthusiastic acceptance in still other fields . . . silicones being only one of these.

If your production requires dependable mixing machinery which is capable of long service at lowest maintenance and operating costs, it will pay you to consult a B-P sales engineer . . . or write us today.

351

BAKER PERKINS INC.

CHEMICAL MACHINERY DIVISION • SAGINAW, MICHIGAN

LITERATURE . . .

Speed Reducers.....Complete new Catalog SB-517 on spiral bevel speed reducers presents design features, selection tables, service factors and arrangements, dimensions, ratings and parts lists.
516A Phila. Gear Works.

Switches, Pyrometer.....New literature lists details on all manual and motor-driven precision pyrometer switches in Alnor line. Line is designed to meet specific problems in multi-circuit pyrometry.
516B Illinois Testing Lab.

Switches, Selector.....Installations of many thermocouples or resistance bulbs may be checked rapidly and frequently through key or push-button selector switches described in new Bulletin 24-1.
516C Thermo Electric Co.

Transformers, Variable.....Powerstat variable transformers are discussed in 16 page Bulletin P550. Data on connections, motor drives, oil-cooled and explosion-proof models, line correctors, etc.
516D Superior Electric Co.

Turbines, Gas.....Westinghouse gas turbines offer reliability and economy; cost per horsepower is low and few men are needed to supervise the installations. Process sketches.
448 *Westinghouse Electric.

Handling & Packaging

Bags, Explosives.....Illustrated booklet tells about specialized bags for explosives used by mining industry. Covers laminated burlap bags, multiwall paper bags and plastic bags with list of sizes.
516E Chase Bag Co.

Containers, Chemical.....Lightweight, stainless steel acid containers build a safe, compact stack; save warehouse space. Many returnable shipping containers listed in Hackney Drum & Barrel Cat.
15 *Pressed Steel Tank Co.

Containers, Stainless.....Lower unit cost with USS stainless containers. Welded chimes, reinforced rolling hoops, five to 55-gallon capacities. Get free report immediately.
73 *U. S. Steel Co.

Control Industrial Truck.....Features and operating details of the Roto-Cam control available on a full line of electric Walkie-type materials handling trucks are described in Circular 34-H.
516F Lewis-Shepard Products.

Conveying Equipment.....Dravo Corp. is now licensed to manufacture vibro-conveyor equipment based on original designs developed and patented in Germany. Complete information in Bulletin 1475.
440 *Dravo Corp.

Conveying Systems, Pneumatic..... Both portable and stationary pneumatic conveying systems described in Bulletin 143-B cover capacity ranges from ¾ through 10 tons/hr. Refers to pressure and vacuum systems.
516G Spencer Turbine Co.

* From advertisement, this issue.

Conveyors.....Ajax Lo-Veyors are compact, self-contained units that can be suspended from ceilings, giving maximum flow capacity in a limited space. Details available in Bulletin 39.
B550 *Ajax Flexible Coupling

Conveyors, Airstream..... Detailed technical information on how you can solve many bulk material handling problems with pneumatic conveying given in Bulletin 530 on Airstream Conveyors.
517A Dracco Corp.

Delivery System, Gas.....How to deliver industrial gases in bulk is described in Catalog 450, "Bulk Gas Delivery Systems." Covers types of delivery units, typical installations, and unit specifications.
517B Air Reduction Sales Co.

Feeders.....Denver wet reagent feeder accurately meters minute quantities of liquid from 0 cc. to 2000 cc. per minute. It is used in multiples for higher capacities. Please write for Bulletin F6-B9.
342e *Denver Equipment Co.

Feeders, Rotary Airlock.....Standard duty for low pressure dust control systems, heavy duty for higher pressure dust control or pneumatic conveying systems and blow-thru types in Bulletin P-55.
506 *Prater Pulverizer.

Marking Machines.....Machines that mark, date and code production runs of goods packaged in cartons are described in a new catalog. Equipment can be adapted to any conveyor line.
Industrial Marking Equipment.
517C

Materials Handling.....Bulletin ECR-106B, "How to Modernize Your Materials Handling Operations With Two Way Radio" shows how the Low Power Industrial Radio cuts costs, improves efficiency.
517D General Electric Co.

Materials Handling System.....How one man can work alone handling materials is discussed in an 8-page circular on the "One-Man Crew." One section tells the equipment needed for this system.
517E Lewis-Shepard Products.

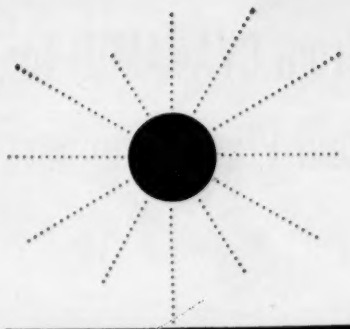
Materials Handling System.....Details of the Tote System for handling bulk materials are presented in a comprehensive, 20-page Catalog 6. Cost saving features are emphasized with list of users.
517F Tote Systems.

Scales.....Weighing is vital to the overall cost control system in any plant; weighing errors or inadequacies lead to losses in output, profits and customer good-will. Weight Fact Kit.
444 *Toledo Scale Co.

Scales.....Bulletins give details on the inner workings of Floaxial scales. Send for Bench and Portable Dial Bulletin, Warehouse Dial Bulletin, and Cabinet Dial Bulletin, available now.
463 *Fairbanks, Morse & Co.

Shakers, Car.....How features of a car shaker increase unloading volume up to 750% are described in "Allis-Chalmers Car Shaker," Bulletin 07B7221B. Unit unloads granular solids from hopper-bottom.
517G Allis-Chalmers Mfg. Co.

*From advertisement, this issue.



HOT

–30° TO 1100° F. OR



COLD

WITH PARTLOW
THE TEMPERATURE IS
PRECISION-CONTROLLED

partlow

THE PIONEER IN MERCURY THERMAL CONTROLS



Recording Temperature Control

Degrees mean dollars. That's why Partlow Controls are used in more and more applications where temperature control is critical. Their pin-point accuracy insures positive protection for materials and equipment. Partlow Controls are precision-built for use with gas, oil, steam or water valves; or electrical equipment. Available in 9 standard ranges, from –30° F. to 1100° F.

THE PARTLOW CORPORATION
Dept. E-1057, 2 Campion Road, New Hartford, N. Y.

We'd like to know more about Partlow Temperature Controls.
☐ Have representative call. ☐ Send us your CONDENSED CATALOG.
We are interested in Partlow Controls for the following applications:

Company.....
Street and Number.....
City..... State.....
Signed.....

What's NEW in '57 from CYANAMID for Ammonia Producers and Plant Designers?



In Gas Reforming:

UNIQUE, LOW CATALYST BULK DENSITY!

AERO* Catalyst NR-1 reduces charge weight and cost because of its low, 51-lbs./ft.³ density. This promoted nickel catalyst in tough extruded Raschig rings has a service shrinkage of only 5% or less in normal operating use.

In Shift Reactions:

TOUGHEST SHIFT CATALYST AVAILABLE!

AERO* Catalyst HI-3 has a service life of five years or more — doesn't disintegrate after contact with water. This modified iron oxide is extruded in sizes to suit your equipment.

In Synthesis Reactions:

FASTEST REDUCTION—UNMATCHED CATALYST LIFE!

AERO* Catalyst FM-2 gives excellent conversion and greatest operating economy at high or low pressure. This promoted and stabilized magnetite is available for quick delivery from local stocks.

*Trademark



These catalysts were developed by Cyanamid through a continuing research program that works closely with operating ammonia producers. Ask your Cyanamid man today for the up-to-date facts.

CYANAMID

AMERICAN CYANAMID COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

LITERATURE . . .

Storage, Tanks, Aluminum.....All sizes available in Alcoa storage tanks. All the advantages at lower cost and faster delivery. Write for Alcoa Standard Storage Tanks Bulletin AD387 for details.
31a *Aluminum Co. of Amer.

Tanks, Dry Bulk.....This company offers detailed information on bulk material storage tanks, both vertical and horizontal, as well as on pneumatic conveying equipment. Bulletins 529 & 549.
498 *Day Co.

Tanks & Vessels, Aluminum.....All-aluminum construction of tanks and vessels assures long life and great freedom from maintenance. Write for brochure on Aluminum Tanks & Vessels.
316-7c *Reynolds Metals Co.

Trucks, Industrial.....Specifications for lift trucks, towing tractors, and platform trucks are given in Bulletin BU-450. Shows basic models and includes load rating chart for the complete truck line.
518A Allis-Chalmers Mfg. Co.

Trucks, Industrial.....You will find the right truck and attachment for practically every mechanical handling application in 12-page guide. Includes working specifications for each truck.
518B Hyster Co.

Heating & Cooling

Air Conditioning Method, Controlled Humidity.....Using air as the cooling medium, Niagara Aero vapor condenser produces a higher vacuum with more economy of power and steam. Bulletin 129R.
524 *Niagara Blower Co.

Boiler-Burner Units.....Titusville 3-Pass boiler-burner unit achieves 80% plus efficiencies, delivers maximum operating economy. Adapted for standard gas, oil or combination burners. Buls.
776 *Titusville Iron Works.

Boilers, Drum.....Within its 12 pages, revised catalog delineates improved features of VC 2-drum boilers as well as design, construction and application information. High capacity saves space, lowers cost.
518C Erie City Iron Works.

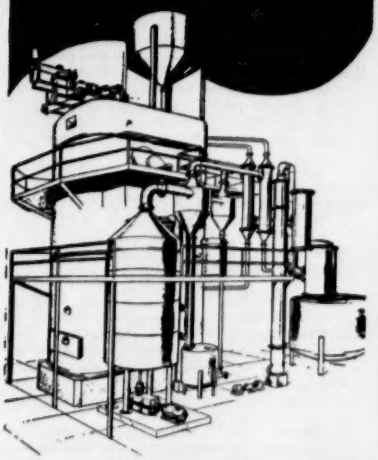
Burners.....Company's burners have automatic proportioning, constantly mix the precise amount of air required for combustion with the gas. Send for free Bulletin SC-156 now.
R540 *Surface Combustion.

Coolers.....Helpful booklet, "Swenson Flash Coolers", gives the facts on peak performance, low cost flash coolers, discusses materials, flash nozzles and adaptations. Bulletin SW-204.
169 *Swenson Evaporator Co.

Coolers.....Young shell and tubular coil sample fluid coolers will reduce temperatures from 600 degrees F. to 100 degrees F. at pressures up to 1500 psi. Write for a copy of Catalog 2125-A.
505 *Young Radiator Co.

*From advertisement, this issue.

FRENCH



EXTRACTION

EXPERTS IN REMOVING SOLUBLES FROM SOLIDS

- MINERAL ORES
- PLASTICS
- SCRAP METAL
- SPICES
- ALFALFA
- OIL SEEDS
- ANIMAL TISSUE

PROCESSING WITH FLAMMABLE SOLVENTS

SOLVENT RECOVERY

DEWATERING

For over 50 years, FOMMCO extraction equipment has had an unusual record of achievement of processing economy and efficiency in the animal and vegetable oil milling field. Now . . . the experience, research and technical knowledge of more than a half century of building extraction plants have been turned to the general chemical field.

Write today for suggestions in solving your extraction problems.

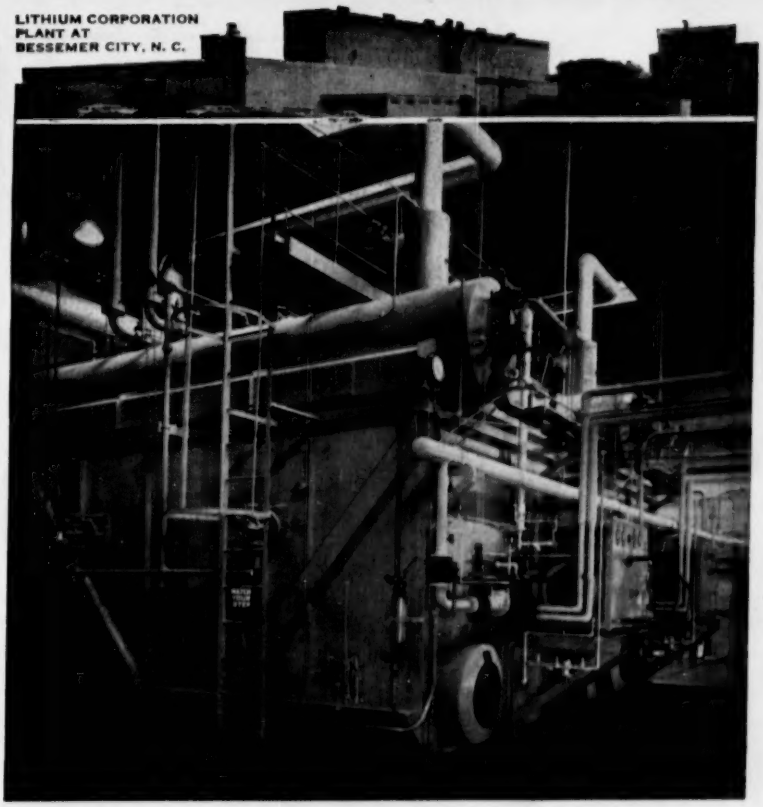
FO2

THE FRENCH OIL MILL MACHINERY CO.

EXTRACTION DIVISION

PIQUA OHIO

LITHIUM CORPORATION PLANT AT BESSEMER CITY, N. C.



Industry's blistering pace demands...

ALL-OUT BOILER PERFORMANCE LIKE LITHIUM CORP. IS GETTING

Lithium, the "Horatio Alger" metal, is making an impact on every segment of industry . . . and Lithium Corp. of America's plant at Bessemer City, N.C. is meeting the mushrooming demand by peak load refining. This processing requires high pressure steam for vacuum jet equipment, a load of 60,000 lbs. per hr. at 140 psi. on the two Bros Packaged Boilers.

This peak load boiler performance is important, of course. Another big point in the Lithium plant boiler room is nominal maintenance; water tube inspection of these Bros boilers after 15 months of near-capacity operation showed *no scale formation.*

That's the kind of performance that makes a real hit with boiler engineers; yet Bros-engineered flexibility and economy pay off in the front office, too. Here's why:

Complete factory-assembled units. Bros Packaged Boilers are self-contained units, easy to transport and easily installed at low cost. They go on-the-line with simple service connections . . . no time or money wasted on slow, costly erections at the plant. These boilers quickly respond to varying loads; they supply steam requirements often expected only of larger, more expensive boiler equipment.

Capacities range from 4,000 lbs. steam per hour and up. Whatever your steam needs, Bros has the precise Packaged Boiler for the job. These units burn oil, gas, or both. Equipped with fully automatic, semi-automatic or manual controls.

BROS

75TH YEAR

POWER DIVISION

BROS *Incorporated*

(formerly Wm. Bros Boiler & Mfg. Co.)

1057 TENTH AVE. S. E. • MINNEAPOLIS 14, MINN.



New production machinery and techniques developed at W-S Fittings Division now assure you of prompt deliveries on corrosion resistant stainless steel pipe fittings. Your local W-S stainless steel distributor will be glad to fill your order from his stock.

W-S 150 lb stainless steel fittings, types 304 and 316, resist a wide variety of corrosive services in petroleum, chemical, petrochemical, food and other process industries. They are also ideal for many low temperature operations because of their inherent toughness at sub-zero conditions. W-S 150 lb fittings can be obtained in sizes ⅛" to 4" in either screwend or socket-welding types to meet your needs.



For detailed technical information on our 150 lb line, send today for Bulletin S-3-55. For prompt price and delivery information call your nearest W-S distributor.

Write to W-S Fittings Division, H. K. Porter Company, Inc., P.O. Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

W-S FITTINGS DIVISION

LITERATURE . . .

Cooling Water Treatment.....How corrosion and deterioration of tower wood was overcome by water treatment is discussed in Technical Paper 137, "A Case History in Cooling Water Treatment."
520A Betz Laboratories.

Ejectors, Steam.....Elliott steam ejectors have proved themselves to be a simple and dependable method of maintaining low absolute pressures. Engineering data offered on all types.
189 *Elliott Co.

Generators, Steam.....Titusville Type WTP steam generators are completely assembled, shipped as a package, easily installed. The 2-drum, water tube generator is described in Bulletin 5511.
77a *Titusville Iron Works.

Generators, Steam.....Standard industrial and packaged steam generating units have completely water cooled walls, efficient firing arrangements, drainable superheaters. Bulletin B-55-4.
391 *Foster Wheeler Co.

Heat Exchangers.....Company offers Monthly Availability Report and catalogs on heat exchangers which produce more hot water, save space and money. More hot water from smaller units.
407a *Bell & Gossett Co.

Heat Exchangers.....Patented ell bolt construction used on Vogt floating head heat exchangers is the answer to reassembly without distortion or leak development. Send for Bulletin HE-6.
297 *Henry Vogt Mach. Co.

Heat Exchangers.....Alcotwin heat exchangers have wide range of metallurgies—tubes and fine can be made of the precise materials to secure best results for your application. Bulletin FH-3.
394 *Alcoa Products Inc.

Heat Exchangers.....Pfaudler's prestocked stainless steel heat exchangers are available on a two-week delivery basis; both single- and double-pass units in a variety of sizes. Bul. 837.
570 *Pfaudler Co.

Heat Exchangers.....“Design and Cost Comparison of Heat Exchangers” enables you to analyze rapidly comparable costs between a plain condenser tube and a Trufin Type S/T shell and tube exchanger.
520B Wolverine Tube Div.

Heat Transfer.....Bul. HT-24 suggests that design engineers approach heat transfer problems without limiting their thinking to specific equipment. Shows advantages for manufacturer's different types.
520C National-U. S. Radiator Co.

Heaters.....“Gradiation Heating for Petroleum and Chemical Processing” contains complete information on low-capacity, compact Selas Gradiation heaters, with instant response. Bulletin 1010.
402 *Selas Corp. of Amer.

Heaters, Dielectric.....Faster production and lowered costs are advantages of Allis-Chalmers' dielectric heaters. Bulletin 15B6431C tells story. Write to Industrial Equipment Div.
71 *Allis-Chalmers.

*From advertisement, this issue.

Heaters, Electric.....Thermoshell electric heating elements for pipe, tube and tank heating described in bulletin are resistance coils embedded in strong ceramic block to withstand excessive temperatures.
521A Cooley Electric Mfg. Co.

Heaters, Electric.....Hook-up schematics and installation photographs in new 8-page bulletin, Supplement 202A, show how electric heaters can be installed in storage tanks used for viscous liquids.
521B Turbine Equipment Co.

Heating & Cooling Equipment..... Custom built stainless steel equipment for heating or cooling fluids, condensing gases, evaporating liquids, dissipating waste heat. Write for brochure.
450 *Marlo Coil Co.

Kilns.....Traylor single support type roller bearings demonstrate leadership in kiln engineering, since efficiency of modern rotary kilns depends on their roller supports. Bulletin 1115 offered.
222D *Traylor Eng. & Mfg. Co.

Ovens.....Company manufactures ovens for dehydrating, curing, paint finishing, industrial and laboratory uses. V-39 laboratory oven is described in Bulletin No. 100, available on request.
T545 *Despatch Oven Co.

Thermo-Panels.....Dean Thermo-Panel coils have many applications in the chemical field, solving heat transmission problems. They have no electrical hazards, need little space. Bulletins 355 & 257.
TL551 *Dean Products Co.

Traps, Steam.....Yarway impulse steam traps can meet your needs—normal loads, high or low capacity, high or low pressure. Request copies of booklet, "Banish Your Steam Trap Troubles", & Cat.
62-3 *Yarnall-Waring Co.

Traps, Steam.....Nicholson steam traps are tested in actual steam service before every shipment. Operating features include high air-venting capacity. Other features included in Bulletin 1055.
88 *W. H. Nicholson & Co.

Traps, Steam.....The Armstrong Steam Trap Book contains 44 pages of useful data on trap sizing, calculation of condensate loads, installation and maintenance. It is free on request.
431 *Armstrong Machine Works.

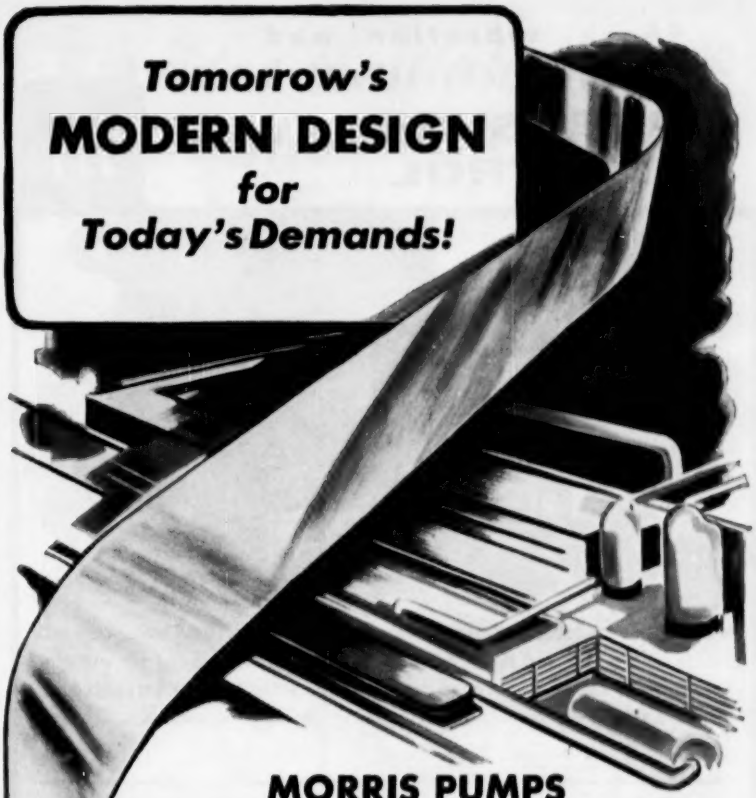
Tubes, Aluminum Heat Exchanger..... Long, dependable service under severe conditions. Excellent thermal conductivity, free from embrittlement at low temperatures. Send for booklet AD186.
30a *Aluminum Co. of Amer.

Instruments & Controls

Analyzer, Moisture.....In Tech-Talk No. 1 are details on model 104 NMR analyzer which measures moisture in granular or fibrous solids with very high accuracy and reproducibility.
521C Schlumberger Well Surveying.

*From advertisement, this issue.

Tomorrow's
MODERN DESIGN
for
Today's Demands!



MORRIS PUMPS
keep the aluminum industry rolling toward
GREATER CAPACITY

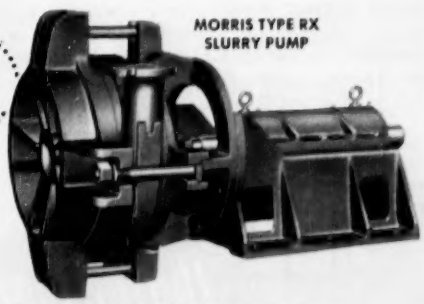
In pace with the far-sighted aluminum industry, other leading manufacturers the country over shrewdly specify Morris for heavy duty pumping.

The Morris Type RX Slurry Pump is rugged, dependable, and trouble free. It's specifically designed for heavy pumping; gives peak performance under all conditions, including heavy, coarse or fine slurries, dispersions and sludges.

The Morris pump operates with minimum attention . . . lowers maintenance costs . . . can be quickly dismantled for inspection . . . avoids lengthy lay-up time. For heavy duty pumping . . . specify Morris.

WRITE TO MORRIS TODAY for recommendations of the pump best suited to your size, capacity, specifications. Ask for Bulletin 185.

MORRIS
CENTRIFUGAL
PUMPS



MORRIS TYPE RX
SLURRY PUMP



MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Sales Offices in Principal Cities

Shock, vibration, and water resistant

PRESSURE CONTROL

J11



Type **J11** Multi-Purpose

The Type J11 pressure control is an enclosed, precision built, rugged unit with water and shock resistant features. It is designed for surface mounting, has a cast bronze case, and has steel bearing surfaces and lock washers for applications involving shock or vibration.

Adjustable Pressure Ranges	various models cover ranges between limits of 0 to 600 psi and 0 to 30" Hg, Vac.
Switch Ratings	15 amps or 20 amps at 115 or 230 volts A.C.; D.C., manual reset, high ambient & other switches available upon specification.
Switch Types	N.C., N.O., or double throw, no neutral position
Electrical Connections	Screw type terminals on switch are standard
On-Off Switch Differential	Fixed and uniform throughout specified range is standard
Mounting	¼" NPT female, brass fitting is standard
Variations	Design variations are available upon specification
Application	On industrial equipment and engine applications . . . marine, aircraft and special purpose

UNITED ELECTRIC *manufactures a complete line of temperature, pressure, and vacuum controls. For applications requiring custom-built units or modified standard units, call upon a UE application engineer for recommendations. Write for complete specification and pricing data on the Type J11. Similar data available on all other UE controls.*

UE®

United Electric Controls

COMPANY

85 SCHOOL STREET, WATERTOWN, MASS

LITERATURE . . .

Analyzer, Oxygen.....Series 11-4000 oxygen analyzer measures the oxygen content in process plant gas streams, according to information in Bulletin 11-40. It records, controls and telemeters.
522A Davis Instruments.

Chromatograph.....Type 26-201 chromatograph maintains constant sample size, constant carrier flow rate and constant temperature; uses no vacuum tubes. Get Bulletin CEC 1831-X28.
199 *Consol. Electrodynamics.

Chromatograph, Process.....Bulletin 1836A tells you that the new Type 26-202 process chromatograph is a reliable, accurate instrument for process control. Characteristics and operating details.
522B Consolidated Electrodynamics.

Computers.....For those interested in learning more about the scientific and engineering use of computers, Booklet EL335 presents a bibliography of computer literature, is first of its kind in industry.
522C Sperry Rand Corp.

Controllers.....Redesigned P-4 controller has even lower steady state air consumption and increased amplifying relay capacity, greater flexibility. Send for your new Catalog 53P-4000.
153 *Fischer & Porter Co.

Controllers, Electronic.... The 'American-Microsen' Series C100 electronic controllers can be interchanged at the panelboard. Controller settings are calibrated, repeatable. Bul. RC100.
98 *Manning, Maxwell & Moore.

Controllers, Flow.....Model 59 flow control system features complete elimination of controller-to-valve response delay, even when the operating panel is hundreds of feet away. Request Bul. 470.
123 *Foxboro Co.

Controllers, Pneumatic Process..... New Transcope controller is compact, simple, smooth and responsive to adjustments. It offers exceptional adaptability, simple maintenance. Bulletin 98278.
390 *Taylor Instrument Co.

Controls.....Series 4000 Thermotrols for indicating, controlling or recording service have standard operating ranges of —40 to 1000 degrees F. All are mercury-actuated. Bulletin T 1585.
372 *Barber-Colman Co.

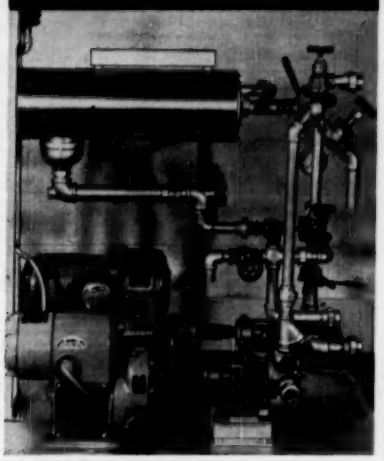
Control, Combustion.....Booklet 1 is first of 10 on "Systems Engineering Applied to Combustion Control." This booklet develops reasons for and the fundamentals of draft control. Explains interlocks.
522D Cleveland Fuel Equipment.

Controls, Edge Position.....Application Bulletin 26.1 tells how Askania edge position controls maintain a desired lateral edge position within 1/64 in. during processing of paper, film and foil webs.
522E Askania Regulator Co.

Controls, Edge Position.....How the Askania edge position control maintains correct edge position on polyethylene slitters and rewinders and on laminating operations is discussed in Application Bulletin 28.1.
522F Askania Regulator Co.

* From advertisement, this issue.

Would
PRECISION
PUMPING
help you too?



Thermal unit does successful job with Viking Pumps

Precision pumping by two Viking heavy-duty pumps contributes much to the highly successful operation of starch cooking units built by Thermal Equipment Corporation, Skokie, Illinois.

WHERE USED—Units cook starch continuously in many applications, including paper, textile, food and other fields. Example: unit easily cooks 25% paste of unmodified cornstarch.

HOW USED—With variable speed drives, the pumps are used to regulate the mixture of slurry and water in the pressure chamber. The slurry pump can be varied from 0.5 to 5.0 gallons per minute—the water pump from 5.0 to 20.0 gpm.

WHAT VIKINGS CAN DO FOR YOU

Whether you need precision pumping or have some other pumping problem, Vikings may be your answer. Vikings are the best answer for pumping many liquids—from viscous or thick semi-solids to light, liquefied gases. With Viking Pumps, you have: Self priming —smooth, even flow—controlled capacity —positive action—no splashing or pounding—no spasmodic operation—no foaming or churning.

For information, call on your nearby Viking Pump distributor, or write for bulletin 575c.

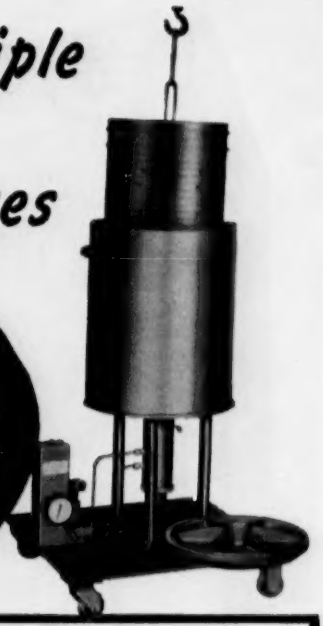
VIKING — the leader, not a follower, in Rotary Pumps

VIKING PUMP CO.
Cedar Falls, Iowa, U.S.A.
In Canada, it's ***"ROTO-KING"*** pumps

See our Catalog in
SWEET'S Plant Engineers File.

Provides Multiple Filtration Advantages

SHRIVER PRESSURE FILTER

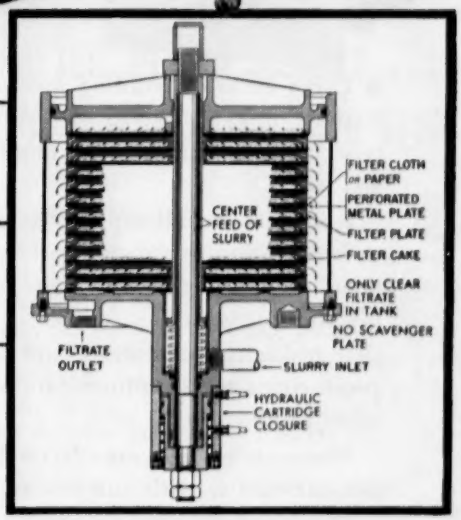


NO LEAKAGE

NO EVAPORATION

NO CONTAMINATION

most versatile



This horizontal plate, enclosed tank type filter handles any fluid from the lightest, most volatile liquid to heavy slurries or viscous materials. It clarifies, purifies, polishes and extracts, recovers and washes filter cake and even practically dries it. Operation can be batch or continuous.

The cartridge is hermetically sealed in the tank. It permits build-up of firm, uniform cake of desired thickness which cannot break off the plates, even when run in interrupted.

There is no pressure in the tank, no unfiltered material. Flow rate is fast—up to 60 gal. per sq. ft. of filtering area per hr. Any filter medium can be used.

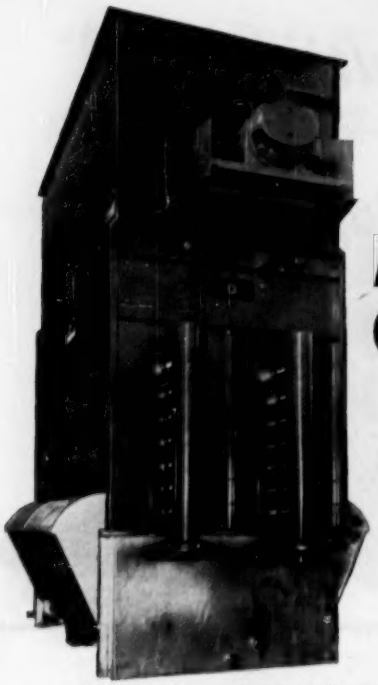
Removal of cartridge, cleaning and reassembly are simple, quick, easy.

Where others have failed—the Shriver Pressure Filter has more than proved its mettle. Bulletin 138A tells how.

Filter Presses
Filter Media
Diaphragm Pumps
Thickeners
Slab Formers
Electrolytic Cells

T. SHRIVER & COMPANY, Inc.

802 Hamilton St., Harrison, N. J.
Sales Representatives in
Decatur, Ga.—Houston, Tex.—St. Louis, Mo.—San Francisco—Montreal—Toronto



This AIR-COOLED CONDENSER produces a Higher Vacuum

● Using air as the cooling medium, the Niagara *Aero* Vapor Condenser produces a higher vacuum than other type condensers, and with more economy of power and steam.

It sustains its full capacity in cooling or condensing with no more than a nominal cooling water requirement, eliminating entirely your problems of water supply and disposal.

It holds constant the liquid or vapor temperature producing always uniform products and giving maximum production.

Non-condensibles are effectively separated at the condensate outlet, with sub-cooling, after separation for higher vacuum pump efficiency.

Niagara *Aero* Vapor Condenser can be mounted directly on the steel structure of your evaporator or distillation column. Its operation is dependable; its maintenance is not troublesome or expensive.

AT THE
CHEMICAL SHOW
26th EXPOSITION OF CHEMICAL INDUSTRIES
Coliseum, New York City, December 2 – 6, 1957
See NIAGARA
AIR CONDITIONERS • *Aero* HEAT EXCHANGERS
Aero AFTER COOLERS • *Aero* REFRIGERANT CONDENSERS • *Aero* STEAM CONDENSERS
Aero VAPOR CONDENSERS • HUMIDIFIERS
HEATERS • COOLERS • DRYERS
BOOTH No. 655

For more information write for Bulletin 129R

NIAGARA BLOWER COMPANY

Over 35 years of Service in Industrial Air Engineering

Dept. CE-10, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

LITERATURE . . .

Controls, Hot Water.....A new 4-page engineering folder helps in the selection and application of McDonnell controls for high temperature hot water installations. Diagrams show how they're used.
524A McDonnell & Miller.

Controls, Pressure.....Type J11 pressure control is an enclosed, precision built, rugged unit with water and shock resistant features. Designed for surface mounting. Specs and prices.
522 *United Elec. Controls.

Controls, Pressure.....Company offers Bulletins 5-5, 5-7 and 5-9 on three models of their automatic pressure controls. Data on purpose, bellows, adjustment, mounting, etc. for each model.
524B United Elec. Controls.

Controls, Temperature.....Partlow temperature controls have pin-point accuracy, insuring protection for materials and equipment. For use with gas, oil, steam or water valves. Cat.
517 *Partlow Corp.

Controls, Temperature.....Bulletin 1025 on electric indicating temperature controls, Bulletin 620 on self-powered temperature controls, Bulletin 710 on self-powered cooling controls.
130 *Sarco Co.

Controls, Tension.....Control system described in Bulletin F-1882 and Spec. Sheet Sec. 351, p. 9 reduces speed of Varidrive precisely as diameter of rewind roll builds up. Used with paper and films.
524C U. S. Elec. Motors.

Density Balance, Gas.....Instrument described in Bulletin 118A is used where specific gravity or density provides an index to gas stream properties. Operating principle depends on a null-balance condition.
524C Arnold O. Beckman.

Flowmeter, Electro-Caloric.....Mass flow rates of fluids in laminar flow are measured with a new model of the Laub flowmeter, Type FM100, according to details available in product bulletin.
524D Industrial Development Lab.

Gages, Liquid Level.....While installing liquid level gages, company's "Floating Shank" lines up off-center holes and protects from mounting stresses. Complete line is described in Catalog 36.
370 *Penberthy Mfg. Co.

Gages, Magnetic.....Jerguson magnetic gage is designed for liquid level observation in plants with danerous explosive or inflammable conditions. Details are offered in an engineering sheet.
L536 *Jerguson Gage & Valve.

Gages, Pressure & Vacuum.....New Catalog 300B is reported to contain the most comprehensive lines of indicating, recording and gage testing instruments available. Complete details in 112 pages.
524E Manning, Maxwell, Moore.

Instruments, Mechanical.....Complete data on all Weston Mechanical Instruments available in Catalog MM-2-C. Line includes indicating and recording controllers, for temperature, pressure, etc.
40-1 *Weston Elecl. Instrument.

*From advertisement, this issue.

Instruments, Pneumatic.....Line of pneumatic instruments includes pressure, differential pressure, temperature and control transmitters. Feature null-balance-vector principle. Folios.
214 *Republic Flow Meters.

Instruments, Recordings.....Weksler recording instruments for temperature and pressure have superior design, greater accuracy, extra longevity, maximum safety. Send for Bulletin R57.
BL551 *Weksler Thermometer Co.

Meters.....With this repeating Auto-Stop meter, you set the required quantity only once, simply by pressing buttons. Then open the valve and the meter does the rest. Metering Bulletin 566-0.
525 *Neptune Meter Co.

Meter, pH.....How pushbutton operation provides automatic accuracy in pH readings at your fingertips is told in Bulletin 705. Zeromatic meter provides easier, faster routine pH measurements.
525A Beckman Instruments

Meters, Time Interval.....Data File 112, "Time Interval Measurements and How to Make Them," contains diagrams, photos and schematics to show techniques for using time interval meters.
525B Beckman Instruments.

Meters & Controls.....Instruments introduced within the past year have been included in 8-page, 1957 edition of Bailey's Annual Bulletin G15-1. Also, applications, ranges and references on complete line.
525C Bailey Meter Co.

Monitor, Moisture.....What the type 26-301 moisture monitor is and how it is used are set forth in Bulletin 1834A. Unit monitors or controls trace quantities of moisture in gases or gaseous mixtures.
525Ca Consol. Electrodynamics.

Monitor, Process Moisture.....New 4-page bulletin announces Type 26-310 moisture monitor designed to measure moisture of in-plant process streams continuously. Accurate down to 1 ppm.
525D Consolidated Electrodynamics.

Pyrometers.....You can read any surface temperature accurately in less than 3 seconds with an Alnor portable Pyrocon. Company provides full details in Bulletin 4257, on request.
L513 *Illinois Testing Labs.

Pyrometer, Surface & Air.....According to leaflet on Alnor Type 2300B pyrometer, instrument combines the functions of measuring surface temperatures and air temperatures. Reads nearest ½° F., 150° span.
525E Illinois Testing Lab.

Regulators, Pressure.....Features of Crane's improved No. 960 regulators for controlling pressure of air or steam up to 250 psi. and 450 F. are presented in folder. Selection tables, diagrams, tips.
525F Crane Co.

Regulators, Temperature.....Powers No. 11 self-operating temperature regulator is simple, compact and dependable. Full throttling action without any external power source. Bulletins 329 and 330.
R381 *Powers Regulator Co.

*From advertisement, this issue.



NEW

METER WITH A MEMORY...
NEPTUNE REPEATING AUTO-STOP

Set it once...delivers same quantity of liquid batch after batch

You batch faster, free operator's time for other duties, and prevent setting errors with this *repeating* Auto-Stop meter. Set the quantity required by the formula just once, simply by pressing buttons. Then open the valve and the meter does the rest. It shuts off automatically at the exact amount. The meter "remembers"... delivers the same amount each time the valve is opened until reset for a different quantity.

Neptune meters end spoiled batches, overfilling, spillage and slow weighing. No more buckets or gauge sticks. Meters are safer, too. Hazardous liquids stay inside the pipe.

You can now meter hundreds of liquids... hot and cold water, syrups, oils, solvents, soap solutions and many chemicals. Auto-Stop meter capacities 5 to 300 gpm. Other Neptune features include ticket-printing registers and electrical Auto-Switch (shown above) to control pumps, valves or signals. Neptune Meters with simple counters or dials also available from ⅝ to 6 in. Ask for free technical metering Bulletin 566-O.



neptune liquid METERS

NEPTUNE METER COMPANY
19 West 50th Street, New York 20, N. Y.

Branches in ATLANTA · BOSTON · CHICAGO · DALLAS · DENVER · LOS ANGELES · LOUISVILLE · No. KANSAS CITY, Mo. · PHILADELPHIA · PORTLAND, ORE. · SAN FRANCISCO (Millbrae) · IN CANADA, TORONTO 14, ONT.



FRICK

Refrigeration Serves Big Armour Laboratories

Armour and Co. use "cold" in many ways in their great Pharmaceutical Laboratories, recently opened near Kankakee, Ill. These uses include air conditioning, biological process work, cold storage, heat-pump service, and research.

Temperatures can be held anywhere between —45 and +45 degrees F., but usually go no lower than —10.

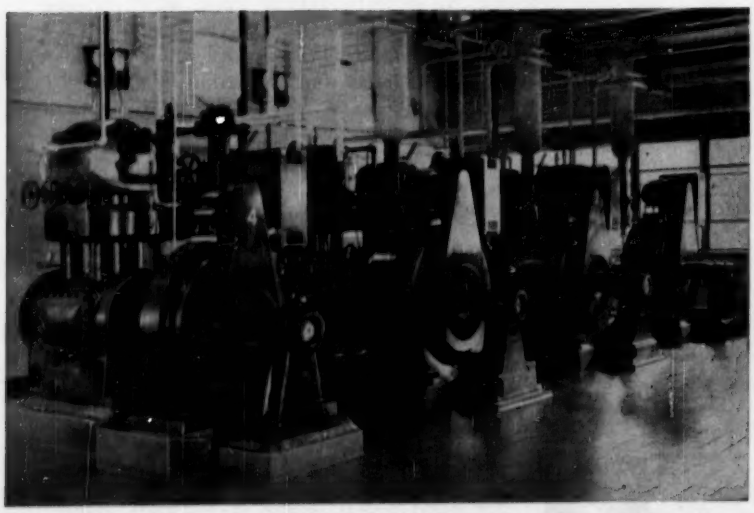
Here a 2-stage Frick system of 1422 tons refrigerating capacity operates with efficiency and economy. Installation by Midwest Engineering and Equipment Co., Frick Sales-Representatives in Chicago.

For that important refrigerating, air conditioning, ice making or quick freezing job of yours, look to dependable Frick equipment. Sales-engineering and service, the world over. Let us submit estimates now: write, wire or phone.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.



Four of eleven ammonia compressors furnishing refrigeration at temperatures down to —45°F for The Armour Laboratories, Kankakee, Ill.

LITERATURE . . .

Rotameter.....In Rotameter Bulletin 115 is revealed a metering float design that permits interchangeability, allowing minimum inventory of spare parts. Now adaptable to advanced instrumentation.
526A Brooks Rotameter Co.

Rotameter.....Bulletin describes new Sho-Rate rotameter with 150 mm. scale length which provides greater readability. Though low in cost, this meter has many features found in costlier instruments.
526B Brooks Rotameter Co.

System, Data Processing....."A Practical Data System for the Process Industries" outlines the economics of automatic data processing in the well-instrumented plant. Covers application to present plant.
525C Beckman Instruments.

Tape, Magnetic Instrumentation..... "Scotch brand Magnetic Tape for Instrumentation Use" reveals that each tape is designed specifically for an exacting instrumentation application. Request a copy.
525D Minnesota Mining & Mfg. Co.

Time Totalizer.....Complete technical and application data on a new industrial, laboratory or military eleectrical reset time totalizer, Cramer Type 691, now available in Bulletin No. PB-691.
526E Cramer Controls Co.

Transducers, Pressure.....New performance data on manufacturer's line of piezoelectric pressure transducers is given in 2-page technical note No. 2. Covers linearity, dynamic range and effect of aging, etc.
526F Atlantic Research Corp.

Transducer, Valve Position.....Data sheet describes details of valve position transducer for remote indication or control of valve stem or valve position. Output used with indicators or recorders.
526G H. E. Sostman & Co.

Pipe, Fittings, Valves

Couplings, Flexible.....Among the couplings covered by Catalog 7 is the Diamond taper-bushed flexible coupling. Charts show horsepower ratings, dimensions, maximum speed and other data.
526H Diamond Chain Co.

Fittings & Flanges, Aluminum..... Tube Turns catalog provides helpful information on aluminum pipe, fiitting and flange materials. You can buy all your fiittings with only one order, save time.
69-70 *Tube Turns.

Fittings & Flanges, Stainless Company can be the one source for all your stainless steel fiitting requirements—screwed, flanged, welding. Bulletin ASA-757 (prices) and complete Cat.
359 *Camco Products Inc.

Fittings, Stainless Steel.....Cooper Alloy stainless steel fittings are backed up by the most intensive continuing research program in the industry. Catalog 55F is available to you on request.
418 *Cooper Alloy Corp.

*From advertisement, this issue.

Fittings, Stainless Steel.....W-S 150 lb. stainless steel pipe fittings resist a wide variety of corrosive services in the chemical process industries. Ask for descriptive Bulletin S-3-35.
520 *H. K. Porter Co.

Hose, Dacron Jacketed.....Booklet tells about the properties of industrial fire hose jacketed with Du Pont Dacron fiber and gives names of manufacturers. Available on request.
428 *Du Pont Co.

Joints, Expansion.....Solve pressure and temperature problems. Range in size from ½ inch to world's largest-28 feet in diameter. Write for latest Sola-Flex catalog for complete line.
76 *Solar Aircraft Co.

Joints, Expansion.....Flexon expansion joints are free-flexing and controlled-flexing, dual and multiple types, balanced joints and other designs. Send for expansion joint design guide.
366 *Flexonics Corp.

Joints, Expansion.....Hyptor toroidal expansion joints with thin-walled bellows have minimum stress at high pressures, superior performance at high temperatures. 72-p. Expansion Joint Manual.
464 *Zallea Brothers.

Liquid Handling Equipment.....New Catalog 65 is a 100-page brochure on loading-arms, loading valves, swing joints, truck tank equipment, storage tank fittings for handling bulk liquids.
527A Wheaton Brass Works.

Lubricants, Plug Valve.....Lubricants recommended for plug valves on nearly 4,000 service conditions are found in Section 5A of Reference Book 39. Also shows accessories, fittings, lubrictors and guns.
527B Valve Mfg. Co.

Nozzles, Spray.....For a perfect, conical shape spray all the time, many plants prefer Monarch spray nozzles. Reduce clogging; used for acid chambers, air washing, etc. Cats. 6A, 6C.
R533 *Monarch Mfg. Works.

Nozzles, Spray.....Your application for nozzles may be commonplace or complex, but whatever it is, properly engineered spray nozzles can make a vast difference. Send for your Catalog.
T548 *Spraying Systems.

Pipe Cutter, Rotary.....44-page catalog presents information about Wallace cut-machining units that cut a wide variety of pipe, tubing and structural shapes. Units available for wide range of sizes.
527C Wallace Supplies Mfg. Co.

Pipe & Fittings.....Bulletin PF/2a deals with Duriron split flanged pipe and fittings. General data, specification charts and information on plastic pipe fittings and special connections.
527D Duriron Co.

Pipe Fittings & Valves, Plastic..... Illustrative brochure and stock catalog gives you latest informatio non plastic pipe fittings and valves, data and illustrations, and detailed valve diagram.
527E Sloane Mfg. Co.

*From advertisement, this issue.

Haveg Equipment Solves Corrosion Problems in Handling
ACIDS · ALKALIS · SOLVENTS · HF · FUMES

First name in Corrosion Resistant Equipment

HAVEG®

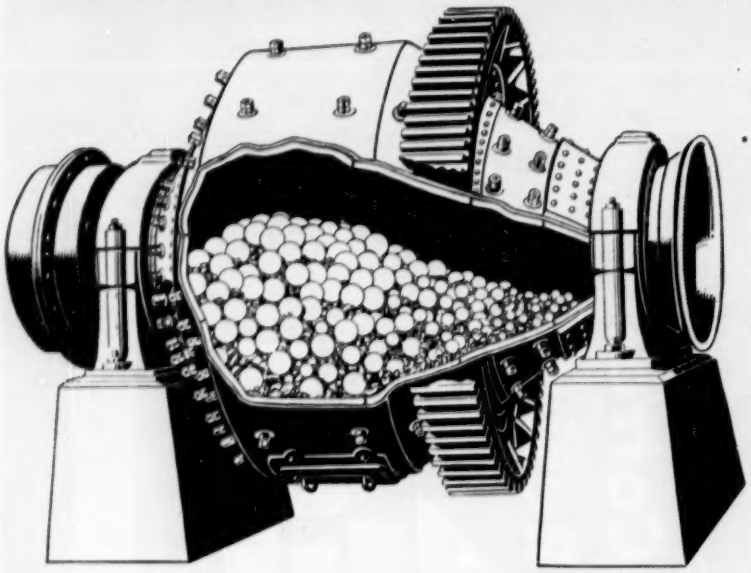
HEAT EXCHANGERS
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FUME DUCTS
PIPING
PUMPS
VALVES

For More Information See Chemical Engineering Catalog

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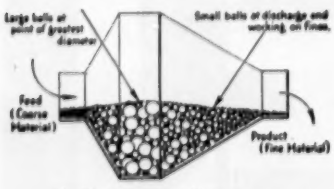
Atlanta, Cedar 7-3821 • Chicago (Wheaton), WHeaton 8-3225 • Cleveland (Solon), CHurchill 8-6194 • Detroit (Livonia), Kingsley 1-1781 • Houston (Bellaire), MOhawk 7-6319 • Los Angeles (Alhambra), CYpress 1-1339 • New York (Westfield N. J.), WEstfield 2-7383 • Seattle, Main 9006 • Denver, BEImont 7-0433 • Canada, Montreal, Glenview 7791 • Toronto, Mutual 2-5557 • Monterrey, Mexico

NATURAL BALL SEGREGATION

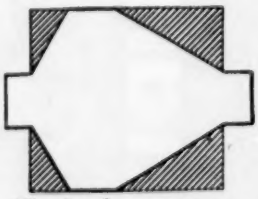


Hardinge Conical Mills Provide Higher Grinding Efficiency

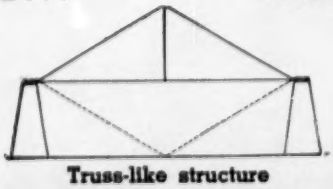
Hardinge Conical Ball and Pebble Mills are used for grinding wet or dry, in open or in closed circuit, either for granular or fine products, depending upon the method employed. The conical shape of the Hardinge Mill causes a rapid circulating and classifying action within the drum, which increases the capacity for power expended over other types. The range of grinding is large, due to the segregation of the sizes within the mill. The conical shape insures extreme rigidity and simplicity. Mechanical troubles are practically unknown. Sizes range from 2 feet to 10 feet with capacities from a few pounds per hour to 100 tons per hour. Bulletin 17-C-11 gives full details of dry grinding applications; Bulletin AH-389-11, wet grinding.



Ball segregation . . .



No dead corners . . .



Truss-like structure

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LITERATURE . . .

Pipe Support.....Chart gives recommended support spacing for polyvinyl chloride pipe of different schedules and sizes. This and other valuable application data given in Booklet TTP 119R.
217b *Tube Turns Plastics

Pipe, Aluminum.....Corrosion resistant aluminum process pipe withstands materials such as hydrogen peroxide, nitrogen solutions, many acids, alcohols, petroleum products. Process Pipe Bulletin.
316-7a *Reynolds Metals Co.

Pipe, Aluminum Steam-traced.....New and improved design of Unitrace, unique aluminum steam-traced pipe with the steam line an integral part of the pipe. Unitrace is further described in Bul. AD418.
30c *Aluminum Co. of Amer.

Pipe, Rigid PVC.....Details on regular and high-impact rigid polyvinyl pipe are found in 12-page catalog. Includes sizes, applications, properties, temperature factors at various pressures.
528A Alpha Plastics.

Pipe Benders, Power.....According to new descriptive bulletin, Form E-224, a new lightweight hydraulic bender makes a full 90 deg. bend with one ram stroke on pipe and conduit smaller than 4 in. Illustrated.
T546 Greenlee Tool Co.

Pipe & Fittings, PVC.....Smooth inside surface of rigid unplasticized polyvinyl chloride pipe and flittings means less corrosion and internal slime and scale. Bulletin PVC 1200 offered.
R542 *Luzerne Rubber Co.

Pipe & Fittings, PVC.....Help in solving your selection of PVC pipe and flittings for handling corrosive fluids will be found in Bulletin PF-1200 and price list offered to interested parties.
528B Luzerne Rubber Co.

Pipe Hangers..... Functional spring hangers with patented internal swivel action provide two-way control over movement of piping. Full information is given in Catalog No. 54 on request.
410a *Blaw-Knox Co.

Pipe, Plastic.....Rivicior rigid plastic pipe has good resistance to chemicals and excellent aging characteristics, high strength, toughness, easy workability. Details in Bulletin CE-56.
352 *American Hard Rubber.

Pipe, Polyethylene ..... Ace Parian odorless, tasteless, rigid polyethylene pipe has excellent impact strength at sub-zero temperatures, high chemical resistance. Bulletin 351.
353a *American Hard Rubber.

Pipe & Tubing.....How you can overcome problems encountered in bending pipe and tubing is disclosed in Bulletin TDC-187. 6 p. folder shows various methods of bending and supplies helpful hints.
528C Babcock & Wilcox Co.

Process Piping, Aluminum.....Alcoa corrosion-resistant process piping prevents product contamination and discoloration. Available for all schedules. Get Aluminum Pipe and Fittings booklet, AD197.
30b *Aluminum Co. of Amer.

*From advertisement, this issue.

Tubes, Steam, Rotary.....Davenport has supplied two large rotary steam dryers to an Illinois grain plant for conditioning and drying soy bean meal, about 2,000,000 lb. per day. Catalog A.
B545 *Davenport Mach. & Fndry

Tubing, Aluminum Heat Exchanger.....Company offers informative 16 p. brochure, "Reynolds Aluminum for Heat Exchangers", which discusses such advantages as lower cost, less tendency to foul.
316-7b *Reynolds Metals Co.

Tubing, Seamless.....Bulletin TB-340A, "A Guide to the Choice of Seamless Mechanical Tubing," explains cost and time-saving benefits of tubing over other forms of stock. Shows differences between types.
530A Babcock & Wilcox Co.

Tubing, Stainless Steel.....Company gives special service on replacement orders from their large inventory of stainless strip. Write for free booklet, "Damascus Stainless Steel Welded Tubing".
12 *Damascus Tube Co.

Valve Diaphragm, Teflon-Faced..... Technical information bulletin 103 presents information about a diaphragm for Hills-McCanna valves made with solid Teflon sheeting with elastomeric backing.
530B Hills-McCanna Co.

Valve Positioners.....Fisher E-Positrol is a fast, sensitive electro-pneumatic valve positioner designed for dependable, accurate valve control. Full details available in Bulletin E-3541.
26-7 *Fisher Governor Co.

Valves.....Strahman ram type drain valves will not clog up. They are designed for the chemical and pharmaceutical industries. No possibility of outlet becoming plugged. Catalog.
L384 *Strahman Valves.

Valves.....Company's tubing and tubing valves save threading and welding, eliminate costly piping. Positive safety locking device prevents inadvertent loosening of gland nut. Bulletin 857.
414 *Autoclave Engineers.

Valves, Alloy.....Crane corrosion-resistant alloy valves (in stainless steel and Craneloy 20) protect against product contamination and cut maintenance and installation costs. Circular 2080.
229 *Crane Co.

Valves, Automatic Regulating.....The advantages of external pilots in automatic regulating valves include simplified maintenance; Spence pilots fit all sizes of Spence main valves. Bul. 1005.
416 *Spence Eng. Co.

Valves, Ball-Type Pipeline.....Designed for process use, the all-bronze Hale PB-1½ ball-type pipeline valve turns easily at all pressures up to 600 psi. in either direction. Operating specs. and dwgs.
530C Hale Fire Pump Co.

Valves, Check.....Unplasticized polyvinyl chloride lift check valve provides 100% flow area and may be installed in either vertical or horizontal position. Write for Folder TTP 150 now.
217a *Tube Turns Plastics.

*From advertisement, this issue.

IS A-C POLYETHYLENE "X"* THE X FACTOR IN YOUR PROCESS?

Stories of successful application of A-C POLYETHYLENE are pouring in from so many fields and industries that we haven't had an opportunity to explore the apparently limitless uses of this exciting new polymer. So we're asking you! If your field of operation is even remotely similar to those below, it is very probable that A-C POLYETHYLENE can give you increased sales, lower costs and many other advantages. Find out today!

Look what it's done for others!

X **Injection Molders** are getting shorter cycles, complete control of flow, higher gloss, sure mold release, with the ability to mold larger and more intricate parts.

X **Polish Makers** use it in its emulsifiable form and call it the "Polish Maker's Polyethylene". They're getting finish durability, non-slip properties, and rebuffability!

X **Paper Converters** use it as a hot melt and are enthusiastic about the low-cost quality coating it offers. Grease resistance, scuff resistance and single feed to automatic machines are other advantages!

X **Dairy Carton Coaters** add it to waxes for their cartons, getting longer shelf life and reducing flaking, leaking and bulging!

X **Food Packagers** like the smarter, glossier appearance of their packages—less rub-off and scuff. Printing looks better, too!

X **Box Makers** coat interior surfaces of corrugated cartons with an A-C POLYETHYLENE-Paraffin blend to eliminate the need for liners! Scratch from paper fibers on fine finishes is eliminated!

X **Textile Finishers** find A-C POLYETHYLENE surprisingly versatile for sizes or finishes. Excellent hand, sewability, durability, abrasion resistance and many production advantages result from using this polymer!

X **Ink and Paint Manufacturers** are satisfied that A-C POLYETHYLENE adds anti-smudge and scuff resistance characteristics to their products!

X **Slush Molders** use A-C POLYETHYLENE with other polyethylenes and end up with a "brand new" material, giving them simpler production with lowest mold costs. The finished articles are tough, colorful and have fine detail!

X **Film Extruders** are using A-C POLYETHYLENE for faster extrusion rates, lower machine temperatures, easier gauge control and less all around machine stress. A-C POLYETHYLENE is a natural for coloring films. Color concentrates made with A-C POLYETHYLENE produce brilliant, uniformly colored film!

X **Squeeze Bottle Makers** are praising the glossy finish and even color when using A-C POLYETHYLENE. They like the faster molding operation, too!

X* = PROFITS, QUALITY, PRODUCTION...

When it's **A-C® Polyethylene**

LET US SHOW YOU HOW A-C POLYETHYLENE CAN BE THE "X" FACTOR IN YOUR PROCESS!

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We manufacture _____

Please send information indicating how A-C POLYETHYLENE can help us.

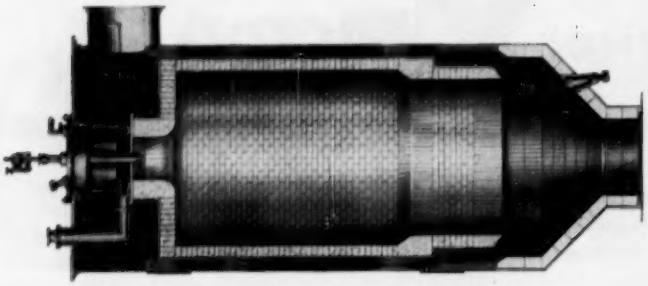
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Hundreds of Peabody Direct-Fired Air Heaters are delivering the heat that never fails in petroleum refineries and process industries all over the world—the sun never sets on Peabody Air Heaters.

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7-094

Valves, Check.....Technocheck is an exclusive valve principle, rugged and versatile, with tight sealing and a low pressure differential. Made of polyvinyl chloride or metal. Bul. Technocheck-PVC.
T552 *Techno Corp.

Valves, Diaphragm.....Versatile dia- details and operating characteristics of air-operated Saunders-patent valves are presented in 8-page Bulletin HB-6. Sizing and selection aids included.
531A Conoflow Corp.

Valves, Diaphragm.....Versatile diaphragm valves are leak tight, packing free, flow safe, self cleansing and easy to service. Made of machinable alloys, plastic and other materials. Cat. 104.
531B Hills-McCanna Co.

Valves, Forged Steel.....Company supplies valve wedges hard as flint, so hard that they withstand the simultaneous attack of corrosion, erosion and galling. Form 195 has specifications.
111 *Ohio Injector Co.

Valves, Gate.....Jenkins U-Bolt gate valves have built-in dollar-saving construction superiorities. They have renewable bonnet saver bushings. The whole line is discussed in Folder 207.
335 *Jenkins Bros.

Valves, Plug.....How you select the right lubricant and apply it to plug valves is described in a new 12-page illustrated manual. Chart lists 560 materials handled and recommended lubricant.
531C Walworth Co.

Valves, Safety Relief.....Consolidated safety relief valves ensure absolute protection for your personnel and equipment—plus low maintenance costs. Full range of sizes available. Cat. 1900.
267 *Manning, Maxwell & Moore.

Valves, Safety & Relief.....Catalog 700A is 146-page aid to help users of safety and relief valves in selection and sizing of valves for a wide range of industrial applications requiring such protection.
531D Manning, Maxwell & Moore.

Valve, Solenoid.....Completely new solenoid valve catalog has 114 pages with 8 indexed sections. Construction details, flow diagrams, cross section views help selection from more than 67 classifications.
531E Automatic Switch Co.

Valves, Stainless Steel.....Company offers information on the complete Crane line of stainless steel valves in Folder AD-2080. Their high quality pays off by cutting maintenance costs. Free.
229 *Crane Co.

Process Equipment

Agitators & Mixers . . . . . Patented standpipe around propeller shaft assures positive agitation and circulation. Open type, air lift and Super Agitator models are available. Bulletin A2-B4.
342a *Denver Equipment Co.

* From advertisement, this issue.

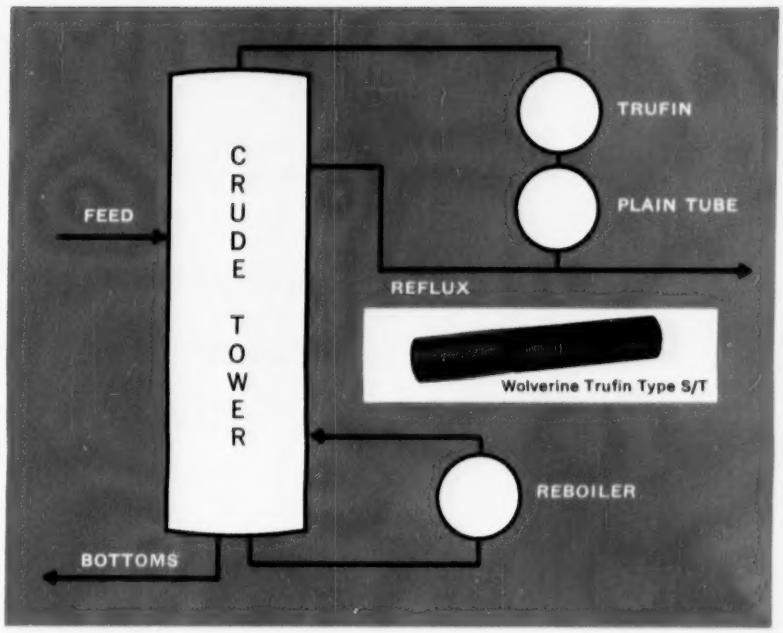
Where Trufin is Most Effective

The use of Wolverine Trufin is most effective in heat transfer applications where outside heat transfer coefficients are low when compared with inside coefficient values — such as those described below.

AIR HEATING OR COOLING where the air is outside the tube and circulating water or condensing steam is inside.

REFRIGERANT AND OTHER HYDROCARBON CONDENSING where the refrigerant is outside and circulating water inside.

OIL COOLING OR HEATING where the oil is outside and steam or water inside. In all such cases the added outside heat transfer surface gained through the use of integrally finned Wolverine Trufin can reduce the size and cost of the heat exchanger and yield real savings.



Can use Trufin in New and Old Units

With the passing of each day Wolverine Trufin Type S/T is finding ever increasing acceptance in the chemical, petro-chemical and petroleum-refining fields . . . for use in retubing existing equipment and in the design of new units.

Retubing an existing heat exchanger can be accomplished, in many instances, simply by directly substituting Trufin Type S/T for plain tube. Because its integral fins give it greater outside surface area Trufin packs more heat transfer surface into a given space —steps up the capacity of existing units.

When designing new equipment Trufin Type S/T permits the design of smaller, more efficient units with a direct saving in materials, time and labor. Trufin Type S/T is widely used in gasoline condensing, butylene condensing and lube oil cooling—is particularly effective in handling light hydrocarbons.

NEW BOOK—FREE

Actual cost breakdowns showing the cost of Wolverine Trufin in actual comparison to prime surface tube are available in Wolverine's brand new book—"Comparative Heat Exchanger Costs". Write for your copy.

Crude Unit:

HEAT DUTY AND ON STREAM TIME BOTH UP WHEN TRUFIN S/T USED

By Ernest Dodd

Met an engineer the other day who accused us of being prejudiced about Wolverine Trufin® Type S/T—the integrally finned condenser tube. Actually we had no defense—how could we feel any other way about a product that performs like Trufin.

Consider, for example, the experience of engineers in a large Eastern refinery when they used Trufin Type S/T in one of two overhead condensers on their crude tower. This unit was placed on stream in March, 1956 and 14 months later was shut down for turn-around.

The application consisted of two units in series—the top one tubed with Wolverine Trufin Type S/T and the lower one with prime surface condenser tube. Upon inspection of the two bundles it was discovered that although the finned tube unit was fouled on the shell side due to the relatively sour crude, the fouling followed the exact contour of the fins. No fins were occluded and the bundle appeared in extremely good condition. This fouling matter was extremely soft and could be cleaned simply by turning a hose on it and washing it out.

However, actual comparison proved that the lower bundle—which was tubed with plain tube—was in very poor shape. The shell side fouling was an extremely tough scale formation which required scraping in order to clean it up. The tube side of this bundle was in approximately the same condition as the finned tube unit.

During the 14 months of operation the engineers at this refinery estimated that they realized a minimum increase in heat duty of 40%. It was also the first time that their crude tower had been operated for a full year—without shutting down to clean the condensers.

Where Wolverine Trufin Type S/T is concerned you just bet that we're prejudiced—and we're proud of it, too. Next time you have a unit off stream for retubing why not look into the economies of Trufin Type S/T . . . and prove for yourself how this integrally finned condenser tube can boost performance while saving you time and money.

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CALUMET DIVISION
WOLVERINE TUBE DIVISION
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CALUMET & HECLA OF CANADA LIMITED
CANADA VULCANIZER AND EQUIPMENT COMPANY LIMITED

WOLVERINE TUBE

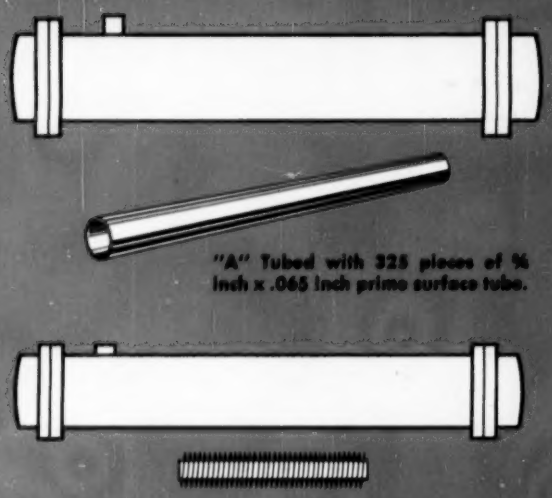
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Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

BUY AMERICAN

HERE'S HOW TO GET MORE BTU'S PER $$$



"A" Tubed with 325 pieces of ¾ inch x .065 inch prime surface tube.

"B" Tubed with 190 pieces of Wolverine Trufin Type S/T—#19506S

Take a look at the sketches of the two shell and tube condensers shown on this page. One is substantially larger than the other—**but both handle the same heat load.**

That's important because it represents vital savings in metal—both in the size of the condenser shell and in the number of tubes required. It also means additional savings in heat exchanger maintenance—**because there are 135 fewer tubes to clean or replace.**

Assuming that Condenser "A" is a four-pass unit and Condenser "B" a two-pass unit, it is interesting to note that "B" (tubed with Trufin Type S/T) **has the least tube side pressure drop.**

With all factors such as alloys, water conditions, temperatures and unit design taken into consideration the use of Trufin Type S/T—with an increase in tube side velocity—can give a greater boost in heat transfer capacities. **This provides the equivalent of additional equipment without additional cost—adds up to more BTU's per $$$.**

Next time you are considering condenser tube—for new equipment or old—remember Wolverine Trufin and the savings it makes possible. For more complete information write for your copy of the Wolverine Trufin Catalog.



This is Wolverine Trufin Type S/T

CALUMET & HECLA, INC.
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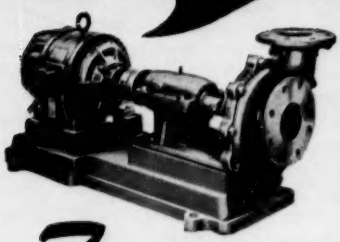
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

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Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

Custom-built for
EFFICIENT
DEPENDABLE
SERVICE



Frederick

SSV PUMPS

Enclosed Impeller and Open Impeller Types

You're sure of maximum service and output with minimum maintenance or production down time with Frederick SSV Centrifugal Pumps because each pump is custom-made to fit your particular operation—whatever the consistency or type of liquid you're moving.

SSV PUMP FEATURES

- **Pump sizes from 1" to 4" discharge openings.**
- **Pump capacities from 50 up to 700 U.S. GPM.**
- **Heads from 30 up to 220 feet.**
- **Pumps speeds can be varied to suit the driving media and operating conditions.**

CONSTRUCTION ADVANTAGES

Pump casings are vertically split for easy accessibility. Mounted on a swivel to permit placing discharge in any desirable position. Pump openings, both suction and discharge, flanged to permit easier connection and disconnecting to joints. One-piece impellers, securely attached to shaft by stout key and lock nut, or threaded, give long service. Pump bearings mounted in sturdy frame horizontally split for easier accessibility. Extra long stuffing box provides for oversize stuffing. Mechanical seal also available for minimum leakage. Pump coupling flexible for direct connection to drivers or can be arranged for belt drive. Pump speed, pump openings, etc. are selected to suit your particular requirements.

Write for Bulletin No. 107

FREDERICK PUMPS

FREDERICK IRON AND STEEL, INC.
FREDERICK Est 1890 MARYLAND

AMERICAN AGILE Custom Built

Corrosion Resistant And Non-Contaminating Plastic Fabrications

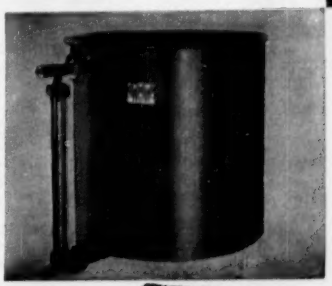
- **Chemically inert**
- **Strong — light in weight**
- **Assure dependable, longer trouble-free operation**
- **Impact resistant**
- **Reduce installation and maintenance costs**
- **Impervious to acids and alkali**
- **Electrically non-conductive**
- **Economical**



Fabricated and welded of AGILENE this fume scrubber has been installed at an atomic energy plant. Entirely impervious to attack by hydrofluoric acid solutions and fluorides up to 170°F., the scrubber is 4' in diameter and 5' high. The entire system is corrosion proof with AGILENE ducting and valves handling a gas flow of 2500 cfm at 1½ psi.

The versatility of polyethylene sheet is demonstrated by these irregular shapes. They have been rolled and formed of ½" polyethylene and then welded. They are being used as shielding in the field of nucleonics. The physical and chemical characteristics of polyethylene make it an excellent material for insulation as well as a corrosion barrier.





Fabricated entirely of AGILIDE (non-plasticized polyvinyl chloride), this self-supporting acid make-up tank is complete with sight glass, valves and shut-off spigot. The tank is 24" in diameter and 30" high with a wall thickness of ¼". Fabricated by the hot gas method of welding, it has been installed at the American Cyanamid plant at Stamford, Conn.

American Agile has the experience and specialized skills and production facilities to fabricate products to specification at the lowest possible cost.

■ **A pioneer in the field of fabrication and welding of polyethylene and polyvinyl chloride, American Agile Corporation places at your disposal the combined skills and know-how evolved through its many years of research and development. Agile's engineers will consult with you at no obligation.**

Write today for your free brochure of AGILENE and AGILIDE fabrications.

AGILENE AGILIDE

Established in 1932

American Agile Corporation

5461 DUNHAM ROAD • MAPLE HEIGHTS, OHIO

VALVES THAT SAVE MONEY!



HERE'S WHY . . . ● *a Much Higher capacity per size, than any other valve* ● *a free-acting, self-aligning disc* ● *a "floating" guide (readily adjustable for control) . . . assists in opening and closing action, as well as affording an additional self-aligning feature* ● *a Disc and Disc holder of forged copper alloy, not castings.*

Briefly, these "features" offer the following advantages: Reduction in size of boiler opening required to mount valve, due to *larger capacity* from small valve sizes—and thus reduced cost of discharge piping. Reduction in boiler head-room. Reduction in shipping charges (less weight). Easier and more positive operations. Easy replacement or reconditioning of working parts (low maintenance).

Available in sizes from 1½" through 6", Lonergan UNI-LINE Valves are V & W National Board approved design . . . product engineered for economy. (A leading boiler manufacturer, name available, has tested, approved and highly appraised all claims.) Write for new descriptive literature.

ESTABLISHED 1872

Lonergan

J. E. LONERGAN COMPANY

209 RACE STREET
PHILADELPHIA 6, PA.

LITERATURE . . .

Blending Equipment.....Automated blending system blends two or more liquids in preset proportions automatically, in closed, continuous production. Highest accuracy. "Blending" Folder.
TR551 *Bowser Inc.

Centrifugals.....Company will install their pilot plant centrifugal for test runs in your plant, under your operating conditions. After you finish the tests, they supply production model. Bul. RC-356.
106a *Heyl & Patterson Inc.

Centrifugals.....When classifying or thickening is desired, the Cyclone is the most economical tool for a plant where continuous flow is preferred. Cyclone Brochure C-954 is available.
106b *Heyl & Patterson Inc.

Centrifugals.....If you are obliged to retain in your finished product all of the crystal characteristics inherent in the slurry and yet require high volume, send for informative Bul. 5405 now.
354 *Western States Mach. Co.

Centrifugals.....Tolhurst Batch-Master centrifugals have hydraulic unloader and bottom discharge, and can unload solids faster than other centrifugals. Details in Bulletin TC-14-56.
382 *Amer. Machine & Metals.

Crushers, Jaw.....Forced-feed jaw crushers have cast steel frames, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection, lengthen roller bearing life. Bul. C12-B12.
342d *Denver Equipment Co.

Demineralizers, Water.... Many of America's high-pressure steam generating plants are protected by Cochrane demineralizers. 2-bed, 3-bed, 4-bed and mixed bed installations. Bul 5800.
117 *Cochrane Corp.

Dissolvers.....Cowles dissolvers with properly sealed, specially designed drives for metallic dispersions are available for all purposes. Proved in actual plant operations. Bulletin 21-1957.
121 *Morehouse-Cowles Inc.

Dryers.....In dozens of industries, Lectrodryers are contributing to quality and speed of production. Booklet, "Because Moisture Isn't Pink", pictures installations drying gases, liquids.
68 *Pittsburgh Lectrodryer.

Dryers.....Denver standard dryers are available in several types, including direct heat, indirect heat and steam tube. Company offers to solve your drying problems. Bulletin D4-B2.
342j *Denver Equipment Co.

Dryers.....Company's Hydryer has exclusive features making it ideal for drying synthesis gas, instrument air and other compressed gases. Longer adsorbent life, no moving parts. Bul. 16.0.081.
504 *J. F. Pritchard & Co.

Dryers.....New Molecu-Dryer, using Molecular Sieves as adsorbents, has advantages of simple design, low initial cost, superior adsorbent, continuous operation. Request a copy of Bulletin 5703.
532A C. I. Hayes, Inc.

*From advertisement, this issue.

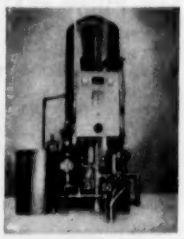
ULTRA-PURE PROCESS WATER

completely automatically

Looking for a Demineralizer effluent with a purity in excess of 15-meg ohms? And fully automatic operation on a "Packaged" unit basis? Then consult Penfield — the pioneer designer and manufacturer of "Packaged" Demineralizers for industry's most critical needs.

Obtainable for fully automatic operation, including the entire regeneration cycle, or for manual control, Penfield Demineralizers are available in mono-column, dual-column and multi-column types — with flow rates from a few gallons per hour to 10,000 G.P.H. and up.

Each Penfield Demineralizer is shipped completely assembled — ready for instant operation upon simple connection with a plant's service lines. Write today for specification sheets on a Penfield "Packaged" unit that will fulfill your requirements for ultra-pure process and make-up water.



An ultra-pure effluent in excess of 15-meg ohms is produced by this fully automatic Model MA Penfield Mono-Column Demineralizer. When purity falls below pre-set standards, the need for regeneration is automatically signalled. The setting of a single switch then accomplishes a complete regeneration cycle, including rinsing and recutting in effluent when desired resistivity (purity) is reached. Model MA units are available with flow rates from 200 to 5,000 G.P.H.



Special Point-of-Use Demineralizing System . . . Each operator's bench is equipped with a T-20 Penfield Mono-Column unit (inset picture) that supplies up to 40 G.P.H. of 10-meg ohms and better water for critical rinsing and make-up needs. Operating costs remain low since the units' mixed bed cation and anion resins are regenerated by the Penfield SR-1 Regenerator (main picture) — an in-plant component of this special Penfield Demineralizing System.

Penfield engineers often can contribute importantly to improved process or end-product results. Phone, wire or write for this consultation service.

PENFIELD

MANUFACTURING COMPANY, INC.
19 High School Ave., Meriden, Conn.



New ALUNDUM* 33-I Insulating Castable

Mixes and pours like concrete . . . protects up to 3300°F.

With ALUNDUM 33-I the ceiling of protection provided by insulating castables goes up to a new high. It is the most effective castable you can get for insulating at temperatures up to 3300°F. This new Norton refractory B̲ provides maximum protection and quick, easy installation in many types of furnaces and other high temperature equipment.

Easy To Install And To Store

ALUNDUM 33-I comes in dry form, in moisture-protective bags. It mixes readily, in about five minutes — you just add water according to instructions. The consistency of the mix is as workable as any cement mix, and can be easily poured into any prefabricated form.

For full particulars, see your Norton Refractories Engineer. Or write to NORTON COMPANY, 510 New Bond Street, Worcester 6, Massachusetts.

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NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

LITERATURE . . .

Dryers, Roto-Louvre.....Roto-Louvre dryer assures uniform drying of the entire surface of each particle of your product, even friable materials and those tending to case-harden. Book 2511.
17 *Link-Belt Co.

Dust Collectors ..... Wheelabrator Dustube collectors pay for themselves in super-clean air, reuse of valuable dry materials, better working conditions. Full details in free Catalog 372C.
404 *Wheelabrator Corp.

Dust Collectors.....Cyclone collectors pay off in efficiency and extra years of operation, with little maintenance. Heavy plate construction. "Collection & Recovery of Industrial Dusts."
452 *Buell Eng. Co.

Dust Collector.....Various arrangements and operation of the Type W RotoClone dust collector are shown in detail in new 16-page Bulletin 274B. Distinguishing features of the unit are set forth clearly.
533A American Air Filter.

Dust Collectors, Wet Type.....How you can reduce hard deposits, congestion and corrosion that interfere with collection efficiency by proper water treatment is disclosed in Bulletin WDC.
533B North Amer. Mogul Prod.

Dust Control Equipment.....Pangborn dust control can increase your machinery life up to 15% or more. Complete line of dry and wet dust collectors, for all jobs. Write for helpful Bulletin 922.
215 *Pangborn Corp.

Dust Separators.....Bulletin 55 shows why and how separating efficiencies of up to 98.9% on foundry shakeout dust are possible, practical and continuous with Hydro-Filter. Request a copy.
L537 *Dust Collector Corp.

Filter Presses.....Sperry filter presses offer improvements to speed your production, reduce operating costs and improve product quality, purity and uniformity. Filtration Cat.
L541 *D. R. Sperry & Co.

Filters.....Whatever your needs—high or low flow rate, pressure, viscosity, pH, or temperature—Ful-flo filters are the answer. Keep apace of new developments in filters by sending to Dept. CE for bul.
20 *Commercial Filters Corp.

Filters.....Model HB and Model H with batch recovery leaf feature are designed to filter a complete preparation down to the last drop without waste. For large and small batch operations. Buls.
222B *Process Filters Inc.

Filters.....Flo-Klean filters are completely automatic and continuously self-cleaning with no loss of backwash fluid, ideal for removing sand and dirt from process liquids. Catalog No. 052.
502 *Cuno Eng. Corp.

Filter, Air.....A new commercial air filter of the general type developed for the AEC is described in a new four-page bulletin. Air-Pure filter can remove particles as small as 0.1 micron dia.
533C Flanders Mill.

* From advertisement, this issue.



BE SURE OF A PERFECT CONICAL SHAPE SPRAY ALL THE TIME WITH *Monarch*

For a perfect spray, many plants prefer Monarch nozzles.

These advanced design nozzles reduce clogging and guarantee dependable applications to . . .

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NFM
SARAN FILTER CLOTH

More than 11,000 hours service for Minneapolis-St. Paul Sanitary District

NFM Saran Filter Covers are really doing a job out here at Minneapolis-St. Paul Sanitary District. Style MS-900 Saran cloth went on these filters November 1, 1954, and several covers have given over 11,000 hours of service. Engineers at this plant say that the use of these filter covers in the Minneapolis-St. Paul continuous flow set-up have proven very satisfactory. Dollar savings in filter cloth costs, down time for changeover, etc. have been considerable.

SARAN is just one of the many types of cloth which we would consider in working on your filtration problems. We also weave cloth of treated Cotton, VINCEL†, NYLON, DYNEL, GLASS, DACRON††, TEFLON***, POLYETHYLENE, ORLON*, and POLYMAX†.

*TM for duPont Acrylic Fiber
***TM for duPont Tetrafluorethylene Fiber
†TM—NFM Reg. U. S. Pat. Off.
††TM for duPont Polyester Fiber

Weavers of Industrial Filter Media for over Fifty Years

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Houston, Texas: 1503 Hadley St.
Oslo, Norway: Nicolai Friis
Johannesburg, South Africa: Edward L. Bateman

LITERATURE . . .

Filters, Air Intake.....Bulletin 100 gives information on Model IDR (ground level), Model DS (silencer), Model D (outdoor) and Model C (indoor) air intake filters. Request your copy now.
212c *Dollinger Co.

Filters, Automatic.....Bulletin 909 covers an automatic water filter frequently used in recirculation systems, providing filtered water for less critical applications. Available on request.
99b *R. P. Adams Co.

Filters, Corrosive Liquid.....Adams displays line of filters for corrosion problems. Rubber or lead linings are available, as well as stainless steel, Monel or nickel construction. Bul. 431.
99c *R. P. Adams Co.

Filters, Diatomite.....The filter is one of the most important pieces of equipment in a water recirculation system; diatomite filters provide an effluent second only to distilled water. Bul. 651.
99a *R. P. Adams Co.

Filters, Disc.....Specially designed segments in Denver disc filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, without blow-back. Bul. FG-B1.
342f *Denver Equipment Co.

Filters, Disc.....Nugent laminated disc filters are designed for filtering fuel oil, lubricating oil and a wide variety of fluids and gases. Illustrated Bulletin 7C contains specifications.
534A Wm. W. Nugent Co.

Filters, Disk.....16-page Bulletin illustrates and describes laminated fiber disk filters for filtering fuel oil, lubricating oil and a wide variety of fluids and gases. Standard, high pressure, duplex.
534B Wm. W. Nugent & Co.

Filters, Heavy Duty.....Sparkler filters help save $80 daily in man hours alone, as reported by one large company. Retractable tank, hydraulic power operated, no spillage. Bulletin available.
28 *Sparkler Mfg. Co.

Filters, Pipe Line.....Bulletin 200 gives information on Model CPH pipe line filter, Model CVH (vacuum), Model AAPHS (absorption) and Models HPH and AHPH (high pressure) pipe line filters.
212b *Dollinger Co.

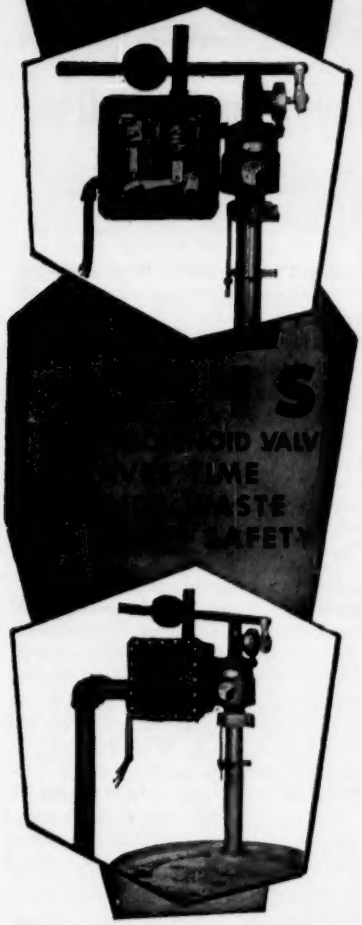
Filters, Pressure.....Horizontal plate, enclosed tank type filter clarifies, purifies, polishes and extracts, recovers and washes filter cake. Operation can be batch or continuous. Bul. 138A.
R523 *T. Shriver & Co.

Filters, Ventilation.....Bulletin 420 on mist collector, Bulletin 400 on precipitator, Bulletin 400 on precipitator, Bulletin 500 on an automatic ventilation filter. Buls. 600 & 700 on dry and viscous panel filters.
212d *Dollinger Co.

Filters, Ventilation.....Dry panel filters for heavy-duty installations in ventilating and air-conditioning systems. Flame-resistant, easily vacuum-cleaned, many types of filtering media. Bulletin 600.
534C Dollinger Corp.

*From advertisement, this issue.

A NEW
AUTOMATIC
VALVE
TO SOLVE YOUR
TANK OR DRUM
FILLING PROBLEMS



Here is the solution to your container filling problems. It is the DAVIS two-step solenoid valve especially designed for accurate weighing and filling. No more guesswork, no more spillage, no more waste. You get faster filling that always keeps step with production. This valve is ruggedly built to withstand years of hard service. Standard or explosion-proof housing available. No matter what liquids you are handling DAVIS can meet your need, giving you the most efficient, economical operation possible.

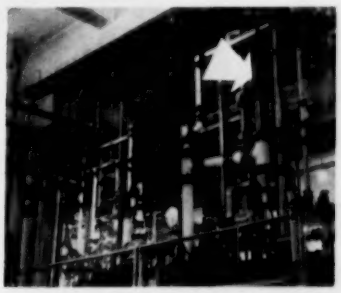
Here is a valve you can sell to many different industries. Solvents chemicals, additives, petroleum products and many others have filling problems. Write for complete details today.



DAVIS REGULATOR COMPANY
2544 South Washtenau • Chicago 8, Illinois

Fansteel
Corrosionomics
REGISTERED U. S. PATENT OFFICE
A JOURNAL OF USEFUL INFORMATION FOR THE SOLUTION OF CORROSION PROBLEMS

VERSATILE TANTALUM CONDENSERS AID PHARMACEUTICAL DEVELOPMENTS

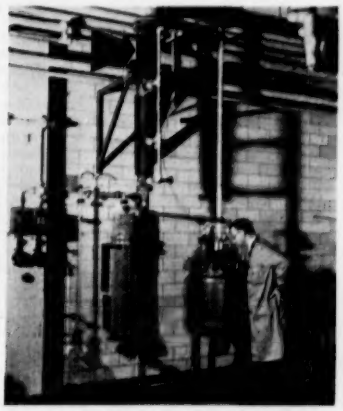


Installation of Fansteel tapered tantalum condenser (arrow) in pilot plant of Abbott Laboratories

Fansteel tantalum tapered condensers are prominent items among the equipment in two pilot plants operated by the Chemical Development Department of Abbott Laboratories, North Chicago, Ill. These condensers are used in the development of new pharmaceuticals and see constant service under highly corrosive processing conditions. Sulfonyl chloride, thionyl chloride, phosphorus oxychloride, phosphorus pentachloride, hydrogen bromide, hydrogen chloride, and nitric acid are but a few of the reagents handled.

Over 17 Years in Corrosive Service

In one plant, two condensers have been in use since 1941 and neither has shown any sign of corrosive attack. In the other plant, two 6″ x 2″ x 60″ units are used—one as a knockback condenser and one for distillation and purification of intermediates requiring special handling.



Special installation of a 6″ x 2″ x 60″ tantalum tapered condenser in the Chemical Development Department of Abbott Laboratories, North Chicago, Illinois. Connected to a 30-gallon Pfaudler glassed steel vessel, the condenser operates under vacuum at 0.5 to 1 mm of mercury, absolute pressure.

Product Purity Maintained

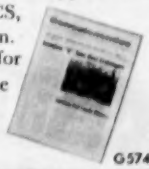
On occasion, the latter system is used to distill an extremely corrosive unsaturated halogen compound. This particular intermediate is subject to polymerization for which ferric chloride is a catalyst. When stainless steel was tried for the condenser, sufficient ferric chloride was formed as a corrosion product to cause polymerization. Inasmuch as tantalum is unaffected by the reagents involved, no contamination results, and, of course, no polymerization is encountered.

In the processing of Abbott pharmaceuticals, tantalum plays an important role. It is noted for its extreme resistance to a wide variety of corrosives and it has the ability to perform several important steps in the processing without affecting the purity of the product. . . . . .

Free Tantalum Test Kit

A corrosion test kit, available without charge to research technicians, contains both tantalum sheet and wire. Request it on your letterhead.

The above condensation is typical of the articles which appear in CORROSIONOMICS, a Fansteel publication. Mail us your name for inclusion on our free mailing list.



1907 FANSTEEL 1957 · Golden Anniversary of Progress

For further data on the above, write:

G574A

FANSTEEL METALLURGICAL CORPORATION
CHEMICAL EQUIPMENT DIVISION
NORTH CHICAGO, ILLINOIS, U. S. A.

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MAGNETIC GAGE

For Liquid Levels



An important advancement in liquid level observation for plants with dangerous explosive or inflammable conditions.

Safety design seals against escaping gases.

Measuring mechanism in stainless steel chamber.

Scale mounted outside chamber; magnetically actuated through chamber wall.

Distinct, accurate level shown in red contrasted with silver above.

Job designed, correlating pressure, temperature, and specific gravity.

For pressures up to 2500 lbs. @ 600° F.

Patent Applied For

Can also be used for interface indication.

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Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

100 Adams Street, Burlington, Mass.

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In Canada: Peacock Bros. Ltd.

LITERATURE . . .

Flotation Equipment . . . . . Denver "SubA" flotation equipment, laboratory and commercial types, give maximum recovery at a low cost per ton. Simplified continuous operation. Bulletin F10-B81.
342g *Denver Equipment Co.

Gasoline Treating.....Two systems for metering sweeteners, inhibitors and metal deactivators to gasoline are described in application engineering data sheet E-57-1. Complete specifications and equipment data.
536A Milton Roy Co.

Generators, Inert Gas.....Kemp inert gas generators end the trouble and expense of bottled gas, provide a highly flexible source of supply at a fraction of the cost. Bulletin I-10 offered.
213 *C. M. Kemp Mfg. Co.

Generator, Inert Gas.....An inert atmosphere of CO_2 and N_2 is produced by the Thermal generator which incorporates a patented and unique combustion system. Details in new Bulletin 114.
536B Thermal Research & Eng.

Grinding.....There is more value in micron-sized particles continuously ground in a fluid energy Jet-o-mizer, operating with air or steam. Described in bulletin along with dust collector.
L542 *Fluid Energy Processing.

Homogenizers, Dispersers, Colloid Mills .....Company offers three booklets—Bulletin C-57 on New RE colloid mills, Bulletin H-55 on homogenizers and Bulletin SMD-55 on sub-micron dispersers.
221b *Manton-Gaulin Mfg. Co.

Homogenizers, Laboratory.....Gaulin "particle control" in blends, emulsions, and dispersions is a dramatic approach to mixing and blending. Free Bulletin LH-55 on laboratory homogenizers.
221a *Manton-Gaulin Mfg. Co.

Homogenizing & Mixing Equipment .....Company offers a comprehensive catalog, the Eppenbach Fact Book, on a line of wet processing equipment including colloid mills, homogenizers and mixers.
R537 *Gifford-Wood Co.

Mills, Ball.....Steel-head ball mills are available with five types of discharge trunnions, all-steel construction. Low initial cost due to quantity production. Send for helpful Bulletin B2-B13.
342b *Denver Equipment Co.

Mills, Imp.....You can do your drying, grinding and separating all in one machine with the Raymond flash drying imp mill. Accessories include new package type furnace. Catalog 77 offered.
230 *Combustion Engineering.

Mixers.....Bulletin B-109 is a condensed catalog showing all types of Lightnin mixers, while Data Sheet B-107 will help you figure your mixer requirements. Both are available from company.
295d *Mixing Equipment Co.

Mixers, Portable.....Versatile portable mixers can be quickly shifted from task to task to allow one mixer to serve many needs. Complete portable mixer information in Bulletin 520-A.
B552 *Eastern Industries.

*From advertisement, this issue.



Says You Can't Use Solvent Recovery?

Not so! A solvent recovery system can cut manufacturing costs in any operation where low-boiling organic solvent vapors can be collected. For instance:

- Acetate fibers manufacture
- Rotogravure printing
- Coating operations
- Plastics processing
- Rubber products manufacture
- Pharmaceutical production
- Dry cleaning
- Metal degreasing operations
- Solvent extraction
- Manufacture of smokeless powder

Solvent recovery is the efficient, economical way to recover solvents vaporized in manufacturing processes. What solvents can be recovered? Well, alcohols, esters, ethers, ketones, hydrocarbons, chlorinated compounds, and practically all mixtures of these solvents can be recovered and reused. And look at these statistics . . . recovery plant efficiency—more than 99%: cost of recovery—1 to 2¢ per pound.

This means that the initial cost of solvents becomes a secondary consideration because they can be used over and over again. Fire and health hazards are reduced, too!

CARBIDE has much more information on how a COLUMBIA Activated Carbon Solvent Recovery system can efficiently and economically recover your process solvents. Write now!

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Division of UNION CARBIDE Corporation

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Unique turbulent area assures positive dust collection at constant efficiency . . . to the micron range

Here is the "heart" of the Hydro-Filter principle of dust separation. This violently turbulent area of water, bubbles and mist is produced by the countercurrent action of air against water. Constant long contact between the air being cleaned and the water which is doing the cleaning produces a scrubbing action which is positive, thorough and unaffected by variation in volume and velocity of flow. Dust is entrained by any, or all, of three means: (1) Entrapment within falling water droplets; (2) Impingement on bubble surfaces; (3) Impingement on wetted surface of glass spheres.

As the photo indicates, the entire collection area is continually flushed. There are no dead areas to corrode or erode. No moving parts to "load up" and reduce efficiency. Maintenance is a matter of *minutes a month*. Collection of dust to micron size is continuous and sludge removal automatic with the National Hydro-Filter.



Write for . . .

See why and how separating efficiencies of up to 98.9% on foundry shakeout dust are possible practical —and continuous with Hydro-Filter!

Bulletin 55

NATIONAL

Dust Collector Corp.

608 Machinery Hall Bldg., Chicago 6, Illinois

Subsidiary of National Engineering Company, Manufacturer of Simpson Mix-Mullers.

LITERATURE . . .

Mixers & Seals..... Bulletin B-112 describes laboratory and small-batch production type mixers; Bulletin B-111 describes rotary mechanical seals for pressure and vacuum mixing. Free.
295c *Mixing Equipment Co.

Mixers, Side Entering & Portable..... Bulletin B-104 describes side entering 1 to 25 HP mixer; Bulletin B-108 describes portable ⅛ to 3 HP mixer. Copies are available to you upon request.
295b *Mixing Equipment Co.

Mixers, Top Entering . . . . . Bulletin B-102 discusses top or bottom entering mixers, turbine, paddle and propeller type; Bulletin B-103 discusses ¼ to 3 HP top entering propellor type mixers.
295a *Mixing Equipment Co.

Mixing Equipment . . . . . Multiple batches of similar or different materials can be economically ground, pulverized or mixed simultaneously on a versatile Abbe jar rolling machine. Request Catalog 79.
L499 *Abbe Eng. Co.

Oil Reclaimers.....Hilco oil reclaimer systems purify vacuum pump oil by continuous re-circulation, on a full-flow or by-pass basis or intermittently on a batch basis. Ask for Bulletin R-160.
349 *Hilliard Corp.

Process Equipment.....Unique application of engineering know-how and imagination in solving difficult processing problems plus wide selection of processing equipment are shown in Bul. 95.
91 *Sprout-Waldron.

Processing Equipment . . . . . A wide range of equipment for processing in various industries is illustrated and described in new 4-page Bulletin No. 57. Includes mills, crushers, pulp mill equipment, etc.
537A Bauer Bros. Co.

Processing Equipment, Dry.....In the 1957, Dry Processing Equipment Catalog, you will find information on air separators and their use in closed-circuit grinding, Micronizer fluid energy mills and blenders.
537B Sturtevant Mill Co.

Pulverizer, Air-Swept.....Color-illustrated, 4-page booklet lists construction and operation features for controlled ultra-fine pulverizing, classifying and conveying in one continuous cycle.
537C Schutz-O'Neill Co.

Samplers.....Heavy duty units, extra rigid track and ball bearing wheels assure positive travel and timing of sample cutter in Denver automatic samplers. Wet and dry cutters. Bulletin S1-B4.
342c *Denver Equipment Co.

Screens, Filter.....catalog presents details on North fine screens for industrial water filter use. Includes specifications, capacities and construction details. Illustrates number of applications.
537D Green Bay F'ndry & Mach. Wks.

Screens, Vibrating.....Type UP vibrating screens are available in open, semi-enclosed and totally-enclosed models. Illustrated Book 2377 discusses them and Type NRM liquid vibrating screens.
537E Link-Belt Co.

*From advertisement, this issue.

FREE!



FACT BOOK on Wet Mixing Homogenizing Colloid Milling

Before you invest in wet mixing or homogenizing equipment, get all the facts about the world-famous Eppenbach line!

Eppenbach Colloid Mills, Homo-Mixers and Agi-Mixers—their unique features and scores of uses —are fully described in this comprehensive new catalog . . . and it's free to anyone who needs answers to perplexing homogenization or mixing problems.

Whatever your product—from cosmetics to pharmaceuticals to printing inks and textile emulsions—you'll find, in Eppenbach Mills and Mixers, ways to simplify and better your wet processing.

Fill out the coupon now. Special mail is facility in your company letterhead. Your book will be sent you at once, with no obligation.

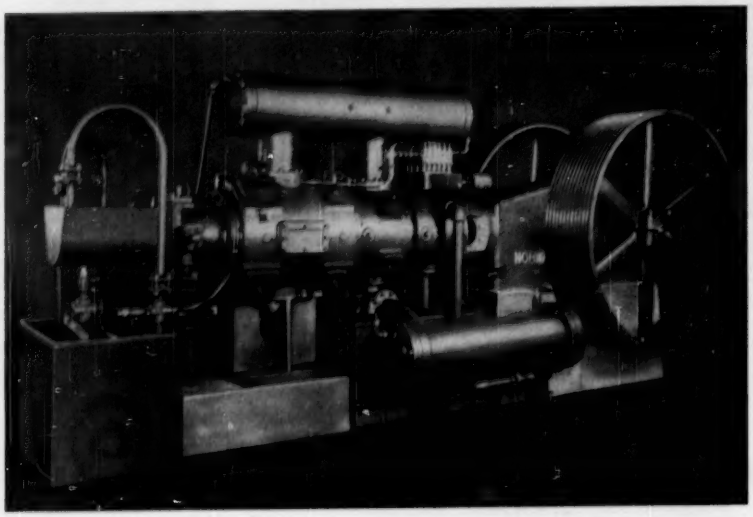
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NORWALK

HIGH PRESSURE COMPRESSOR



The five stages on this heavy-duty tandem compressor require less horsepower and develop less heat than in four stages in producing 3000 lb. per square inch pressure in capacities up to 31,000 cfh.

Frames with double row roller bearings, reversible ring plate valves, force feed lubrication, generous intercooler coils are some of the features that make this horizontal compressor compact, sturdy and efficient to operate and maintain.

Every Norwalk compressor is test-run for eight hours at the factory, then taken down for complete inspection before re-assembly and shipment.

Norwalk makes compressors from single stage to six stages, from 125 to 25,000 lb. psi. Catalog on request.

NORWALK COMPANY, INC.

SOUTH NORWALK, CONNECTICUT

Makers of high pressure compressors since 1864

LITERATURE . . .

Separators, Magnetic.....Eriez offers three major product lines—Hi-Powr magnetic separators, and Hi-Powr magnetic automation, and Hi-Vi Vibratory Equipment. Write for catalog for entire line.
83 *Eriez Mfg. Co.

Strainers, Liquid Line.....Bulletin 6 on large area pipeline strainers designed to remove foreign materials from liquids, oils, air or gases. On engines, they reduce downtime and and maintenance costs.
538A Wm. W. Nugent & Co.

Strainers, Self Cleaning.....Bulletin W-68C tells you about the Banks continuous strainer that strains fluids without interrupting the flow for cleaning the screen. Perforations are only 0.023 in.
538B Golden Anderson Valve Spec.

Strainers, Startup.....New engineering data bulletin on startup or temporary strainers shows all sizes from 2 through 24 in. in regular flange series or ring-type joint. Perforated steel and wire types.
538C M. N. Aitken Co.

Tables, Concentration.....Denver Wilfley concentration tables are ideal for separation of groups of particles having a similar range of specific gravities. Bulletin T1-B3 is offered.
342L *Denver Equipment Co.

Trays, Tower.....Perforated Ripple Tray developed for distillation columns allows major savings on first cost and maintenance, according to brochure now available. Tells how it maintains efficiency.
538D Stone & Webster Eng. Co.

Waste Treatment.....“HiCone System for treating sewage and industrial wastes by the activated sludge process,” described in Cat. 6660 is an improved aeration method that has proven efficient and economical.
538E Yeomans Bros. Co.

Water Treatment Ion Exchange.....“Natural water is a raw material; it should be refined before use,” is asserted by Mueller Corp. Their fold-out bulletin pictures and describes equipment.
538F H. M. Mueller Corp.

Wire Cloth.....Cambridge provides quality and prompt service in filter leaves, strainers, sizing screens, retaining screens. Free 96-page Catalog and stock list available on request.
348 *Cambridge Wire Cloth.

Pumps, Blowers, Compressors

Air Cleaner.....How damage caused by contamination in air from compressors can be prevented is discussed in the new catalog on the Aridifier. Information covers sizes from ¾ to 10 in. air line diameters.
538G Logan Engineering Co.

Compressors.....If you need oil-free air, take advantage of Joy's Bulletin 130-11, filled with information about a line of non-lubricated compressors backed by 25 years of experience.
8 *Joy Mfg. Co.

*From advertisement, this issue.

EPOXY RESINS

JUST OUT! Covers the whole range of information needed to make effective industrial use of epoxy resins. Applications, covered against a background of chemistry and technology of the resins and their reactions in curing, include adhesives and sealants for metals, glasses, and wood, plus many tables of resistance data. **By Henry Lee and Kris Neville, The Epoxylite Corp. 503 pp., 176 illus., 87 tables, $8.00**



NUCLEAR CHEMICAL ENGINEERING

JUST OUT! Latest techniques for effectively *concentrating, purifying, and separating* the materials used in fission reactors. Includes techniques for processing thorium, beryllium, and other materials; for producing separated isotopes such as uranium-235; and for performing other critical engineering operations. **By Manson Benedict and Thomas H. Pigford, Mass. Inst. of Tech. 602 pp., 166 illus., $9.50**

PRACTICAL AUTOMATION

JUST OUT! Shows how to install and use plant automation for increased productivity, lower operating costs, and improved safety. Gives scores of examples of successful installations from plants of all sizes in various industries—demonstrates actual applications and methods—in a way that helps you plan ahead for successful automation. **By L. R. Bittel, M. G. Melden, and R. S. Rice, all of** *Fact. Mgt. & Maint.* **376 pp., illus., $7.50**

MATHEMATICS FOR SCIENCE and ENGINEERING

JUST OUT! Enables you to find, understand, and use with ease and quickness the various mathematical procedures best adapted to solve a particular problem simply and quickly. Covers mathematics all the way from arithmetic to such things as complex numbers, infinite series, and methods of approximation. **By Phillip L. Alger, General Electric Co. 360 pp., 117 illus., $6.95**

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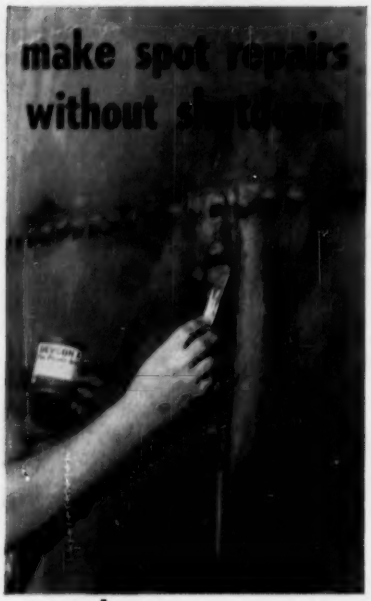
With T-E Quick-Coupling Connectors and Panels

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Write for Bulletin 23-E.

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LITERATURE . . .

Compressors . . . . . Bulletin entitled "Air for Industry" describes company's M-Line natural force balance compressors, 200 to 6000 hp. Explains advantageous new features. Bulletin M-81.
397 *Cooper-Bessemer Corp.

Compressors. . . . . Norwalk makes compressors from single stage to six stages, from 125 to 25,000 lb. psi. Every one of them is test-run for eight hours at the factory. Catalog on request.
538 *Norwalk Co.

Compressors, Centrifugal . . . . . Complete line of centrifugal blowers and multi-stage compressors and turbines for condensing, non-condensing and automatic extraction, applications. Bul. 0504.
423 *De Laval Steam Turbine

Compressors, Centrifugal. . . . . Series RS centrifugal compressors for gas processing work are discussed in 24-page Bulletin C-83. Covers construction details, engineering application data, dimensions.
540A Cooper-Bessemer Corp.

Compressors, Oil-Free Air. . . . . Descriptive flier reports line of oil-free ½-3-hp. air compressors with 25-100 psig. output is ideal for instrument control or other applications where oil-free air is a must.
540B Ingersoll-Rand.

Exhausters & Compressors. . . . . Complete line of single-nozzle and multi-nozzle water jet exhausters, lab. vacuum pumps and barometric hydro-vac exhausters are discussed in new Bulletin 4P.
540C Schutte & Koerting Co.

Fans, Industrial . . . . . Construction, operations and specifications of a rugged line of fans designed for heavy industry are covered in new 24-page Bulletin MD 102. Performance data, dimensions, applications.
540D Chicago Blower Corp.

Pumps. . . . . Practical Guide to Pump Selection contains big illustrations and brief descriptions, with information on capacities and adaptability of pumps. Write for Bulletin S-146.
R384 *Taber Pump Co.

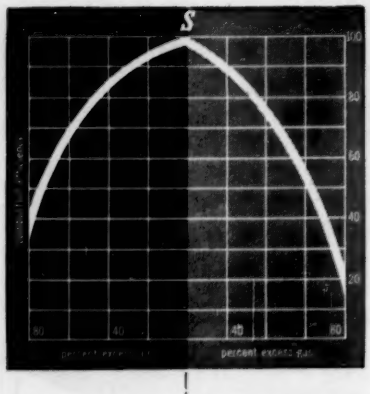
Pumps. . . . . You can pump volatile sludges and slurries without clogging, under a low net positive suction head, without gas or vapor binding. Further details available in Bulletin 206-4.
495 *Lawrence Pumps.

Pumps. . . . . The Morris pump operates with minimum attention, lowers maintenance costs, can be quickly dismantled for inspection, avoids lengthy lay-up time. Write for Bulletin 185 with specifications.
521 *Morris Machine Works.

Pumps. . . . . Micro Bellows pumps help research and development laboratories, especially where highly corrosive liquids are being pumped. Made of stainless steel without packing. Bulletin.
T554 *Research Appliance Co.

Pumps, Acid. . . . . Ace "Wam" is a corrosion resistant non-metallic acid pump with hard rubber casing and impeller, Hastelloy C shaft. It is mechanically simple and trouble-free. Bulletin CE-55.
353b *American Hard Rubber.

*From advertisement, this issue.



Even a little excess air hurts combustion efficiency. | *Excess gas decreases combustion efficiency even more.*

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Another reason you get the most heat per penny spent for fuel with 'Surface' burners: they give you peak combustion efficiency. Conventional burners, with excess air or gas, throw away much of your potentially usable heat. With 'Surface' Automatic Proportioning, the precise amount of air required for complete combustion is constantly mixed with the gas.

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Write for Bulletin SC-156.
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4101 San Jacinto, Houston, Texas

LITERATURE . . .

Pumps, Centrifugal.....Complete line of Standard End Suction Centrifugal pumps is made up of standardized, stocked parts ready for prompt delivery at competitive prices. Bulletin W-300-B4.
46-7 *Worthington Corp.

Pumps, Centrifugal.....BH line of high speed, high head centrifugal pumps have stainless steelshafts, high strength alloy iron casings, hydraulically balanced bronze impellers. Bulletin 2-2e.
80 *Gardner-Denver Co.

Pumps, Centrifugal.....Frederick SSV centrirugal pumps, enclosed impeller and open impeller types, are custom-built for efficient dependable service. Write for your copy of Bulletin 107.
L531 *Frederick Iron & Steel.

Pumps, Chemical ..... Impervite chemical pumps are single stage centrifugals and utilize a near self-cooling and self-lubricating seal which is virtually leakproof. Described in Bulletin 854.
510 *Fallis Industries.

Pumps, Chemical.....Types DL and DM chemical process pumps display a new concept of economy through interchangeability of components They feature accessibility and durability. Bulletin B-1608.
133 *Peerless Pump Div.

Pumps, Corrosion Resistant.....Fig. 3715 pumps come in six different corrosion and abrasion resistant constructions, all available from factory stock on short notice. Full story in Bulletin 725.4.
362 *Goulds Pumps Inc.

Pumps, Corrosion Resistant.....The design benefits of this company's new corrosion resistant pump are described and illustrated in the Waukesha Catalog, yours on request. Send for Bulletin 1957.
R501 *Waukesha Foundry Co.

Pumps, Diaphragm.....What's described as a new concept for metering and proportioning a wide variety of fluids is detailed in Bulletin 301 on the new McCannameter diaphragm pump.
541A Hills-McCanna Co.

Pumps, Filter Press.....Characteristics of pumps commonly used with filter presses are discussed in Technical Data Sheet T4, "Pumps for Your Filter Presses." Includes sketches and simple curves.
541B T. Shriver & Co.

Pumps, Flexible Liner ..... Useful technical data and material selection information will be found in a new comprehensive 8-page catalog on the Flex-i-liner sealless plastic and stainless-steel pump.
541C Vanton Pump & Equipment.

Pumps, Graphite Centrifugal.....How the unique, self-cooling design of the seal eliminates special lubrication and external cooling at temperatures up to 500 F. is told in Bulletin 854.
541D Falls Industries.

Pumps, High Pressure.....Frames of Philadelphia high pressure pumps are designed for ease in compounding any simplex or duplex pump. Wide capacity range. Send for Catalog HP-1255 with charts.
347 *Philadelphia Pump Div.

*From advertisement, this issue.

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CHEMPRO TEFLON* PACKINGS

Long Life Chempro Teflon Packings last for many months under corrosive conditions which destroy conventional packings in days... even hours. Replacement cost on the basis of service life cannot be compared.

Ideal for sealing pump and other rotating shafts against acids, caustics, aromatics, chlorinated hydrocarbons and other powerful corrosives. What's more, they give a *truly tight seal* with only slight gland pressure. Their low coefficient of friction makes lubrication unnecessary. See Bulletin CP 552.



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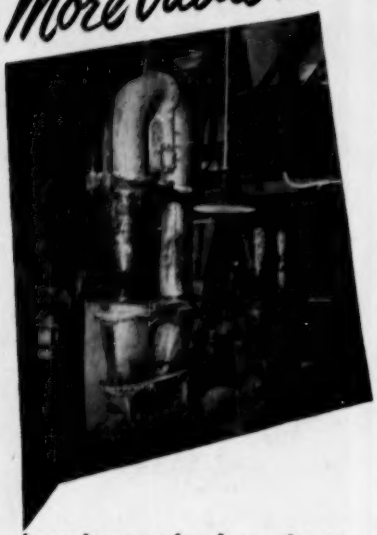
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Jet-o-mizers range from laboratory size to 8000 lbs./hr. production models.

Investigate our complete TEST facilities and our CUSTOM grinding services.

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FLUID ENERGY PROCESSING & EQUIPMENT Company

Richmond & Norris Sts., Philadelphia 25, Pa.
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LITERATURE . . .

Pumps, Jet.... Air and gas pumps that operate on the jet principle using steam or air as the motive force are discussed in new Bulletin 4E. Capacity curves and ratios, consumption tables help selection.
542A Schutte & Koerting Co.

Pumps, Process.....Component interchangeability is a major advantage of Type PR and PRS process pumps according to new bulletin B-1605. Description, performance curves for all sizes.
542B Food Mach. & Chemical Corp.

Pumps, Proportioning.....Design features of this Model 1106 proportioning pump include interchangeable measuring cylinders, super-accurate check valves. Send for a copy of Bulletin 1106-2.
508 *Proportioneers Inc.

Pumps, Proportioning.....Bulletin 602 describes Hills-McCanna "U" pump for small volume metering and proportioning, "K" pump with hydraulic drive, new Hills-McCannameter and Model 4411 metering pump.
542C Hills-McCanna Co.

Pumps, Rotary.....Viking pumps are the best answer, company asserts, for pumping many liquids, from viscous or thick semi-solids to light liquefied gases. Write for helpful Bulletin 57Se.
L523 *Viking Pump Co.

Pumps, Rubber Lined..... Buffalo Type DS pumps, with rubber permanently bonded to the impeller and all liquid passages, prevent costly corrosion. Simplified servicing. Write for helpful Bulletin 982.
124 *Buffalo Pumps.

Pumps, Steam Chest.....Roper Series 3600 pump, with the added feature of a steam chest, is a rotary gear unit available with or without relief valve. Full details available in Bulletin 29.
503 *Geo. D. Roper Corp.

Pumps, Vacuum.....Company offers Catalog 752, "Stokes Microvac Pumps for High Vacuum" and booklet 755, "How to Care for Your Vacuum Pump". Special vertical design cuts floor space needed.
120 *F. J. Stokes Corp.

Pumps, Vertical Turbine.....Deming 4700 vertical turbine pumps are available with water-lubricated design and semi-open, easily adjustable impellers. Specific data offered in Bulletin 4700-A.
368 *Deming Co.

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Above is shown a portion of a typical cell in Western Electric Company's Electroforming plant at their Point Breeze Works. This cell consists of a plastic lined metal shell with hard rubber weir plates fastened to each end. The feed weir shown is cored and connected to the electrolyte supply line by a flexible elbow.

Western Electric reports that a number of materials were considered for fabrication of these weirs and flexible elbows and it was concluded that hard rubber and neoprene provided the best combination of temperature stability, corrosion resistance, mechanical strength, ease of fabrication, and moderate cost.

Luzerne fabricates these hard rubber parts for Western Electric:—Luzerne can solve your corrosion problem too. Write for information on Hard Rubber Molded Products, or send your problem for analysis by our engineering department.

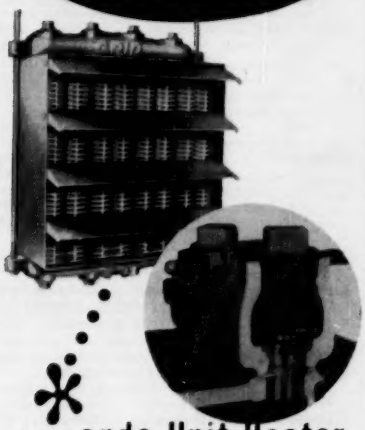


See LUZERNE EXHIBIT in BOOTH NO. 435

The LUZERNE RUBBER CO.

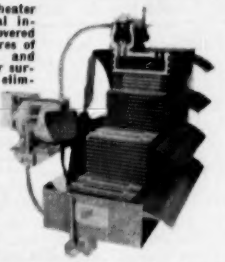
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Note double steam chambers in each fin section and wide fin spacing.



Above illustration is all cast iron one - piece, single chamber fin section used in Models 1000 and 1200. Illustration to the right above is all cast iron one-piece double chamber fin section used in Models 1500 through 3000 . . . wide fin spacing prevents clogging by lint or dust . . . straight through air passage reduces resistance. Single inlet at top serves both steam chambers permitting quick, even steam distribution.



Send for the complete story on GRID Unit Heaters, GRID Blast Heaters, and GRID Radiation for chemical plant use . . . it is contained in GRID Products Catalog No. 956. Write today for your copy.

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LITERATURE . . .

Services, Processes, Misc.

Centrifuge, High-Force.....Details of a 51,000-times-gravity centrifuge given in bulletin SBK-1. New rotor design permits operation up to 25,000 rpm. without rotor overheating.
543A Beckman Instruments.

Design & Construction.....Brochure describes and illustrates the Cosden ethylbenzene plant built around new process concept. Badger know-how is ready to tackle any new process problem.
543B Badger Manufacturing Co.

Dispenser, Acid.....How acids can be dispensed continuously and/or automatically without exposing operator is discussed in Bulletin B-I-F P3. Units handle from 8 to 24 gph. with smaller unit down to 0.8.
543C Proportioneers, Inc.

Engineering & Construction..... Sweco teamwork enable design and construction jobs to be done right and done right on time, company asserts. For more information, send for Brochure E-5-32.
216 *Southwestern Engineering.

Engineering Service.....When your creative facilities are overloaded or when you need expert technical aid, Associated Engineers offers a complete engineering and manufacturing service. Brochure.
543D Associated Engineers.

Equipment Fabrication.....4 p. booklet describes firm's facilities and scope of service to the processing industries in custom fabrication of steel plate and alloys up to 1 in. thickness. Request a copy.
543E Puget Sound Fabricators.

Fire Protection.....Bulletin No. 2426, "Fire Can Destroy Your Business", shows how a Blaw-Knox fire-protection engineer will study your needs and explain how to pay for a sprinkler system.
410b *Blaw-Knox Co.

Fume Hoods.....Fume problems—New design principle illustrated in brochure sweeps hood area with low-velocity stream of fresh air. Eliminates corrosive vapors from hood entrances.
543F Brown Laboratory.

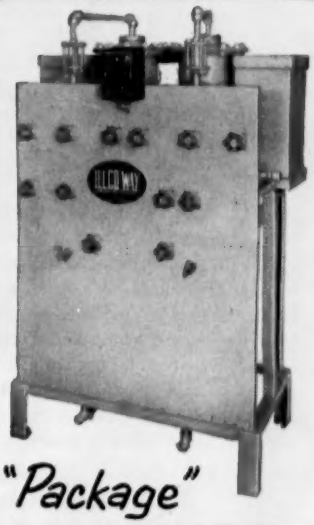
Fume Hoods.....Descriptive literature covers remote control for fume hoods by which air flow for fume exhaust can be changed during the operation of the fume hood, with safety sash open or closed.
543G Laboratory Furniture Co.

Fume Hoods.....Data sheet illustrates closed-type fume hood. Safety glass sash permits observation of hazardous work; design eliminates both dense and light vapors from the hood enclosure.
543H Arthur S. LaPine Co.

Gas Mask.....How the recently introduced Acme "Spec" mask helps gas mask users who wear glasses is told in Bulletin 576. Operating features built into mask overcome problems commonly encountered.
543I Acme Protection Equipment.

*From advertisement, this issue.

ILLCO-WAY ionXchange



"Package"

DE-IONIZER PROVIDES PURIFIED WATER

Here is a complete de-ionizer, all assembled, loaded with resins, and ready to be attached to supply, outlet, and drain lines. Whenever you need low-solids water, you should first plan on the de-ionization process to obtain it, and then consider the outstanding economy, efficiency, and easy installation of an ILLCO-WAY "Package" Unit. Three models are available, each in a wide range of standard sizes: LU Models produce a low-solids water for general use, down to 3 to 5 ppm, but not removing silica or CO_2; HB Models produce quality water usually less than 3 ppm and remove all ions *including* silica and CO_2; MB Models produce an extremely pure effluent, less than 1 ppm, free of silica and CO_2. *Write for literature giving complete details.*

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O_3 . . . an answer to your SO_2 air pollution problem

The problem of eliminating noxious components from gases exhausted to the atmosphere from such sources as sulfuric acid plants, sulfide-ore roasters and power plants becomes more acute as industrial expansion continues. Within the next two decades, for example, an additional one thousand billion kilowatt-hours will be required to meet the needs of industrial and consumer consumption. It is estimated that 80% of this added power will be generated by coal-fired plants, despite the rapid advances in nuclear energy.

One of the most troublesome constituents of these exhaust gases is sulfur dioxide. SO_2 can be efficiently oxidized by air when small amounts of Welsbach ozone are present in a direct process for recovery of sulfuric acid. In this method, ppm quantities of ozone are mixed with the stack gas which is then passed through a diffuser to a column of absorbing solution containing a small amount of manganese. Extensive tests have shown that these trace concentrations of ozone efficiently promote the manganese-catalyzed air oxidation of sulfur dioxide, resulting in recovery of dilute sulfuric acid.

This process not only solves air pollution problems in the removal of sulfur dioxide from waste gases but permits recovery of potentially valuable sulfuric acid. The acid may be used in dilute form, concentrated or upgraded in the production of ammonium sulfate.

Welsbach ozone is versatile and low in cost. Its applications as an oxidant cover numerous fields and point the way to many new and interesting industrial developments. Welsbach tonnage ozone may represent a simple and economical solution to your oxidation problem. As pioneers in ozone plant design and application, Welsbach is equipped to help solve your problem. We shall be pleased to have you call or write for information.



Write for this booklet on Welsbach Ozone Generation for Industrial Application. Please indicate company and title.

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LITERATURE . . .

Ion Retardation.....Bulletin 164-62, 23 p., describes a new process for separating water soluble materials through the use of a new type of resin. Compares process with ion exclusion, ion exchange.
544A Dow Chemical Co.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators, mixers, pulp distributors and several others. Bul. LG3-BIO.
342i *Denver Equipment Co.

Laboratory Equipment.....Company manufacturers a complete line of laboratory furniture and equipment, including tables, cases, cabinets, fume hoods, etc. Send for comprehensive catalog.
TR549 *Duralab Equipment.

Laboratory Equipment.....Data sheets describe two Sartorius projection balances and a micro torsion balance. Line of photography exposure meters and low power micro manipulators also presented.
544B Brinkmann Instruments.

Laboratory Equipment.....Two Reyers balances, one bulk weigher and one analytical balance weighing to 1/100,000 of capacity, described in data sheet. Both have knob operated fractional loaders.
544C Arthur S. LaPine Co.

Laboratory Supplies.....8 p. catalog covers line of disposable plastic products such as petri dishes, culture dishes, cups with and without covers, filtering funnels, culture tubes.
544D Chicago Apparatus Co.

Lubricant Accessory.....Bulletin 22-23 describes follower plates which prevent waste and cut grease residue to a minimum by removing lubricants down to the bottom of 400-lb containers. Request your copy.
544E Stewart-Warner Corp.

Nuclear Engineering.....“Engineering for Atomic Power,” 36 p., describes firm’s role in the development of atomic energy in wartime, outlines its activities in peacetime applications of nuclear power.
544F Stone & Webster.

Percolation Processes.....24 p. bulletin called “Percolation Adsorptive Processes” discusses both static and moving bed processes, particularly in relation to petroleum applications. Bulletin 401.
544G Minerals & Chem. Corp.

Plant Locations.....“Chemicals in the Texas Gulf Coast,” 31 p. booklet, lists the area’s chemical manufacturers and their products, alphabetically arranged both by company and by product.
544H Texas Nat’l. Bank.

* From advertisement, this issue.

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386-7 *Blaw-Knox Co.

Pulp Bleaching.....A comprehensive 60 p. book, "Pulp Bleaching," covers pulp bleaching stages, procedures and systems, including chlorination, chlorine dioxide and peroxide. 52 illustrations.
545B Hooker Electrochem. Co.

Radiation, High-Energy Electron..... A new high-energy electron radiation facility for investigations and production runs now is available on time-rental terms, according to newly released Bulletin F.
545C High Voltage Eng. Co.

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545E Devcon Corp.

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545F Scientific Equipment Co.

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545G Beckman Instruments.

Tests Cloths....."Types of Soiled Fabrics and Procedures for Evaluating Comparative Soil Removal," 3 p., describes scientifically soiled fabric for finding cleaning efficiency of detergents.
545H Foster D. Snell Inc.

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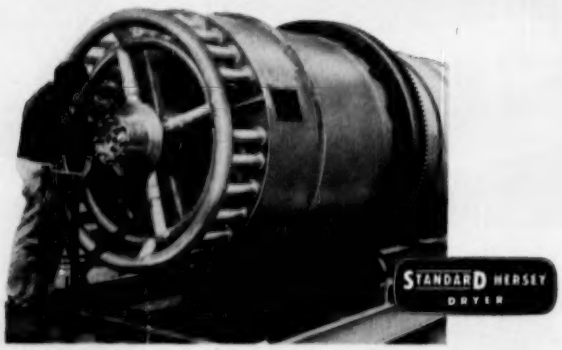
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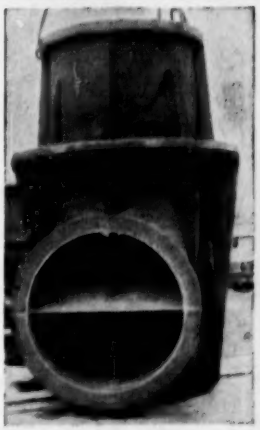
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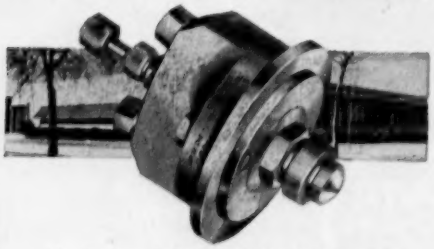
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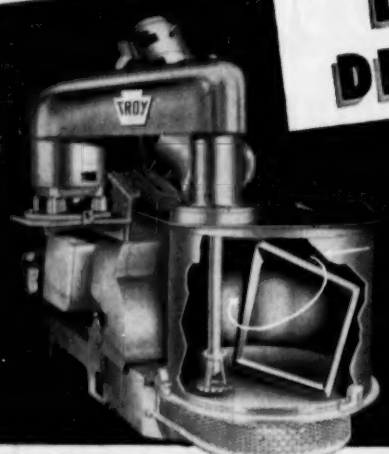
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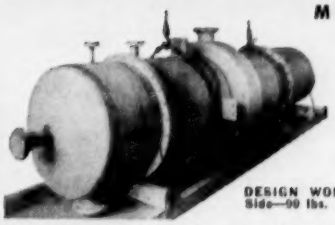
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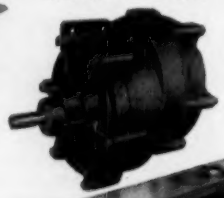
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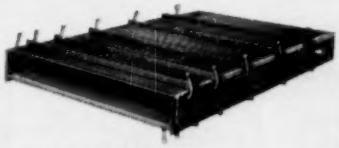
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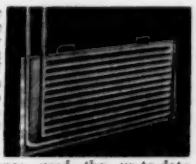
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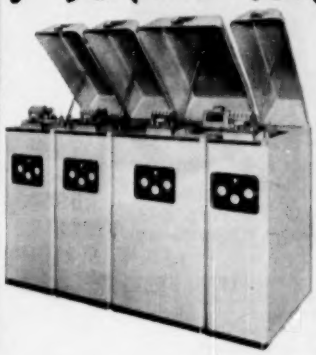
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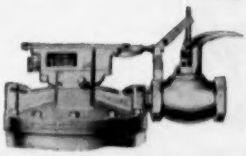
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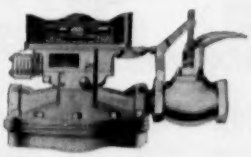


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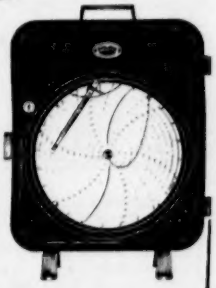
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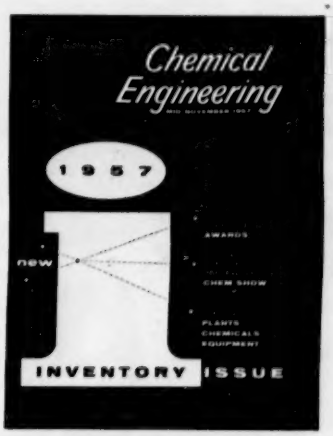
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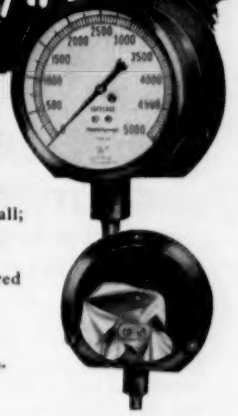
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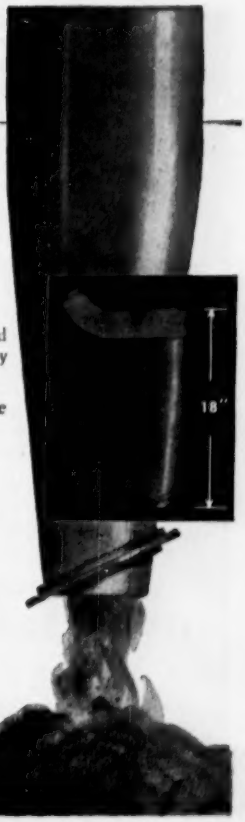
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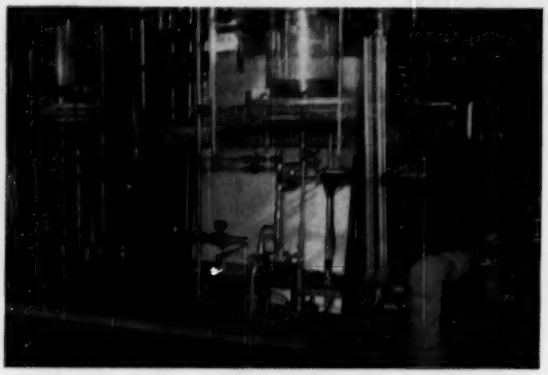
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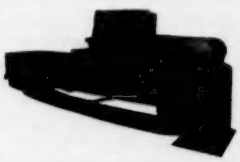
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1—Fletcher 40" suspended basket, 25 HP motor
1—A T & M suspended Centrifugal basket
1—Baker-Perkins Ter-Meer S.S. Centrifuge, 7½ HP motor
1—Bird suspended 48" perforated basket, 30 HP motor

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3—Mikro-Pulverizer Model 1-TH, 2-DH, 3-PF
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1—Schutz O'Neill type A Mill, 5 sets discs & hammers
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1—Sparkler Filter 14-4 Steel.
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1—Allis-Chalmers Type B, 24" x 12" Jaw Crusher
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1—Abbe Eng. 6' x 15' Silex Lined Tube Mill 75 HP motor
1—Patterson 8' x 18' Silex Lined Tube Mill
2—Steadman 40"—6 cage Disintegrators 40 HP motors
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1—Sharples PY-14, Super-D-Canter, 304 S.S.
2—Bird 40" suspended, 347 S.S.
1—Bird 40" suspended, rubber.
3—Tolhurst 40", 32", 28", suspended.
1—AT&M 40" suspended, steel.
1—AT&M 36" center slung, rubber covered, perforated basket.
1—Tolhurst 32" Suspended, 304 S.S., perforated basket.

EVAPORATORS, REACTORS CONDENSERS, TOWERS, TANKS

1—Artisan 450 sq. ft., 304 S.S., single effect Evaporator, complete with piping, receiver, separator and condenser.
1—Nooter 1000 gal. nickel-clad, jacketed, agitated Reactor.
2—Pfaudler 250 gal. glass lined, jacketed, agitated Reactors.
3—Pfaudler 500 and 300 gal., glass lined jacketed Reactors.
1—600 gal., 316 S.S. jacketed, agitated Reactor 200# internal pressure, 75#.
4—3500 gal., 304 S.S. jacketed, agitated.
1—Wyatt 18" dia. x 23', 316 S.S. Bubble Cap Columns.
1—Wyatt 24" dia. x 42', 304 S.S. Bubble Cap Column.
1—10' dia. Hortonsphere, 225 psi.
1—10,000 Aluminum Storage Tank 10' x 16' x ½" shell, 25# W.P.
1—12,000 gal. Horizontal rubber lined Tank 10'6" x 17'4".
4—1000 gal. S.S. Clad, Vertical Tanks.
1—6' x 5', 316 S.S. Vertical Tank.
1—5'6" dia. x 16' long, 304 S.S. Horizontal Tank, 3000 gals.
3—Steel Storage Tanks 8½' x 25', 8' x 16', 6' x 20'.

HEAT EXCHANGERS

1—1665 sq. ft., 304 S.S. tubes, 75 psi.
1—1300 sq. ft., Admiralty Tube, 75 psi.
1—1200 sq. ft., 304 S.S. tubes, 150 psi.
1—947 sq. ft., 304 S.S tubes, 60 psi.
1—570 sq. ft., 304 S.S. tubes, 60 psi.
1—536 sq. ft., 304 S.S. tubes, 150 psi.
1—315 sq. ft., 316 S.S. tubes, 250 psi.
1—250 sq. ft., 316 S.S. tubes, 900 psi.
22—14, 20, 28 & 48 sq. ft., 304 & 316 S.S. tubes.
11—Karbate 24.6 sq. ft., tubular.
2—Karbate 188 sq. ft., tubular.

PULVERIZERS—CRUSHERS

1—Dixie #3620 non-clog Hammermill.
4—NEW Jeffrey Hammermills 20" x 12", 15' x 18".
4—Hardinge Mills, 4½' x 16", 5' x 36", 6' x 22", 10' x 48".
1—International 6' x 7' porcelain lined Pebble Mill, 30 HP motor.
4—Patterson 6' x 8', 5' x 6', 3' x 4' Mills.
1—Devine 5' x 10' steel jacketed Ball Mill.
1—National 6" x 12" Mill, Two Roll.
1—Kent 6" x 14" Three Roll Mill.
3—Gayco Air Separators 16', 6', 18".
3—Mikro Pulverizers, Bantam, #1SH #2DH, 2TH.
2—Ball & Jewell #1, #0 Rotary Cutters.

SCREENS

3—#34 Robinson Triple Deck 30" x 104".
6—#42 Rotex Double Deck 40" x 84".
3—#421 Rotex single deck 60" x 84".
3—Robinson single deck 40" x 84", 304 S.S.
1—Patterson single deck 40" x 84", 304 S.S.
2—Tyler Hummer single deck 3' x 5', 3' x 10', 3' x 12' with Thermionic Units.

MIXERS

1—Baker Perkins #15USE, ALL STAINLESS Double Arm, jacketed, Vacuum.
1—Baker Perkins #15VUMM, 100 gal. jacketed, 100 HP.
2—Baker Perkins #17DAM, 200 gal. jacketed, Sigma Blades.
1—Baker Perkins 50 gal. jacketed, Sigma Blades.
5—Day "Cincinnatus" double arm 250 and 100 gals.
1—Patterson 6' dia. Steel Conical, 15 HP.
5—Steel Powder 50, 225 and 350 cu. ft.
1—10 cu. ft. Ft. "V" Blender, 304 S.S.
1—Eppenbach 1 HP, 304 S.S. Homo Mixer.

MISCELLANEOUS

3—25 Ton Freon Refrigerating Units.
7—Stokes DD2, DB3, D3, B2, "R" & "F" Tablet Presses.
8—Nash Vacuum Pumps H10, H8, H5, L5, T87, #4.
2—Stokes #412G, 412B Vacuum Pumps, motor driven.
8—Wilfley 4" Haveg lined Centrifugal Pumps, motor driven.
15—Chlorimet, Durimet and Duriron Centrifugal Pumps 1½" to 5".

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Centrifugals: Fletcher 12" copper.
Fletcher 20" lithcoated.
Tolhurst 26" copper.
Tolhurst 24", rubber covered.
Centrifuge: Inter. size 3 mod. FS. 2 hp.
Clarifiers: De Laval 84-51, SVKSR, 04-21, De Laval #800 multiple.
Condensers: stainless steel and copper.
Conveyors: screws; Hammond 16" st. steel.
Dryers: Devine 2 x 4' vac. drums, st. steel.
Bowen laboratory Spray type.
Ruggles Coles XA 4 x 20' rotary.
Double drum atmospheric to 120°.
Louisville Davenport Steam Tube.
Nordyke rotary steam 120 lbs/hr.
Evaporators: Swenson triple effect 350 sq. ft., single effect 350 ft.
Mojonnier st. steel, 392 sq. ft.
Fillers: for liquid, paste, powder.
Filters: Oliver 2½ x 1', Sparkler, Alsop, Lomax, Industrial.
Oliver 3.5 sq. ft. monel horizontal.
Eimco 4x3 steel drum, unused.
Oliver 6x4 s. s. drum with flapper.
Filter Presses: Sperry, Shriver 6" to 36".
Kettles: Stainless steel 20 to 500 gal. with and without agitators.
Dopp 150 gal. dbl. st. agitator.
Mills: Pebble, Abbe #5, 36 gal.
Pebble: Abbe #5, 36 gal.
Mikro: No. 1SH Bantam and 24".
Hammer: Jeffrey 30 x 24" type A.
Hammer: Williams size BX type AK.
Raymond: 0000 IMP, 16" screen mill.
3-roll Ross 12 x 30", Day 12x32".
Colloid: Charlotte iron, 25 hp.
Colloid: Charlotte model 20, st. st., 20 hp.
Fitzpatrick model D, st. st., 5 hp.
Mixers: Dbl. and sgl. arm sigma blade. Jacketed horiz. 550 gal. st. steel.
Dry Powder: 1½ to 77 cu. ft.
Day Powder, copper body, 140 cu. ft.
Liquid tank to 500 gal.
Muller: Simpson st. st. bowl 39x20", Pony: Day 40 gal. Ross 20 gal.
Gemco st. st. Tumbler, 7½ hp.
Press: Louisville dewatering 10x22" rolls.
Pumps: Centrifugal, rotary, gear, vacuum. In various sizes and metals.
Reactor: VanAlst st. steel 18 x 60".
Screens: Selectro 4 x 10',
Separators: De Laval AC-VO Nozzle-Matic.
Sterilizers: American 42 x 52" x 11½' lg.
Stills: st. steel 24 x 45", 24 x 32", 20 x 24".
Tablet Machines: Single punch and rotary.
Tanks: Stain. steel, various sizes.
St. steel 2000 gal. jacketed.
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Sharples type M-12-161 H CENTRIFUGE
Patterson Gyro-Centric Screen, complete.
STAINLESS STEEL jacketed kettles 100 gal. and 55 gal. at 90 psi.
Day #2 Cincinnatus Sigma Blade MIXER 20 gal.
W & P lab Sigma Blade MIXER 1 gal.

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2—Model "D" Fitzmills 7½ H.P. Motors.
4—Stokes Rotary B-2 and DD-2 Tablet Machines.
2—Stokes "R" Single Punch Tablet Presses.
3—Day #71 Roball Screens, Stainless Steel.
3—Day #31 and #32 Roball Screens.
1—Day 350 gal. Stainless Steel Sigma Blade Mixer.

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368 CFM	100 PSI	12x10 Ing.—Penn
368 CFM	125 PSI	10-6x7 Joy WN 112
465 CFM	100 PSI	12x11 Penn-Gardner
528 CFM	100 PSI	14x12 Ing. ERI
585 CFM	100 PSI	15-9¼x12 Ing. XRE
890 CFM	100 PSI	13½-8x8 Penn DE2
676 CFM	100 PSI	15-9¼x12 Worth
686 CFM	100 PSI	14x13 Worth HB
868 CFM	100 PSI	17-10x12 Chic. OCE
877 CFM	100 PSI	17-10¼x14 Ing. XRB
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1—Stokes 2' x 6' Rotary Vac Dryer.
1—Albright Nell 4' x 9' Atoms. Drum Dryer.
1—Buffalo Vac. Drum Dryer 24" x 28".
Vac. Shelf Dryers & Kilns.

CENTRIFUGALS & CENTRIFUGES

4—Tolhurst 48" Suspended Type Centrifugals.
8—Centrifugals 12", 30", 40", & 48" Steel, Copper, Stainless & Rubber lined.
6—Sharples Centrifuges #5 Stainless, Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS

#2 Sweetland Filter 12 Stainless Covered leaves.
1—Vallez 41 Stainless Covered Leaf Filter, types 49.
Ertel Eng 6 & 10 disc Filters 12¼" dia.
Sperry & Shriver 7" to 36 sq. in. Iron & Wood.

KETTLES & TANKS

Pfaudler 200 gal. Glass Lined Closed Jack. Kettle.
1—Dopp 550 gal. C. I. Jack. Vac. Kettle.
Devine & Stokes Impreg. Units 30" & 36" dia.
Devine 1000 gal. closed jack. Steel Kettle.
1—2300 gal. Vert. agit. Jack. Steel Kettle.
8—Jacketed Kettles 50 to 2300 gals.
1—250 gal. Lead Lined Kettle.
Pfaudler 150 gal. closed agit. Jack. Steel Kettle. 50 Stainless Alum. Copper, Glass & Lead Lined Kettles & Tanks. Also new Stainless.

PULVERIZERS & MILLS

3—Mikro Pulverizers #4, #281 & 2TH.
Pebble Mills 24" x 30", 30" x 36", 30" x 34", 30" x 42", 4' x 5'. Also Jar Mills.
1—Raymond #00 Pulverizer 30 H.P. Complete.
2—#0000 Raymond Mills.
Sturtevant #0 18" Hinged Hammer Mill.
Jeffrey 18" x 18" Single Roll Crusher.
Day Hercules Spike Crusher 1½ H.P. motor.
Hammer Mills Pulverizers 3 to 50 H.P.
Bauer 24" Hammer Mill.
1—Schutz-O'Neil 20" Pulverizers. Also #1.
Williams #3 & 2xx Hammer Mills.
1—Robinson 18" & 22" Attrition Mill.
1—Lehman 4 Roll W. C. 12 x 36" Steel Mill.
3—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x48".
3—Heuchin 18"x36", 4 Roll Granite Stone Mills.
Ball & Jewell Rotary Cutters Midget, Lab. & Up.
2—U. S. & Premier 1½ H.P. Colloid Mills.

MIXERS & SCREENS

Day Imperial 75 & 150 gal. Jack. Mixers.
Baker Perkins double arm 50 & 100 gals.
2—Read 50 & 100 gal. double arm mixers.
Lancaster 6' dia. vert. Mixer 25 H.P.
Kent 3 H.P. Continuous Dry Mixer.
Horiz. Mixers single & double arm to 200 gal.
3—Day 5, 15 & 40 gal. Pony Mixers.
Read 40 and 80 qt. vertical Mixers.
6—Lead—Paste Mixers 50 to 150 gals.
Tyler 3'x5' Vibratory 2 Deck Sereen. Other sizes.
Blystone 3000# horiz. spiral mixer.
Day Jumbo 700 gal mixer.
10—Dry Spiral Mixers 50 to 3000#.
12—Portable Elec. Agitators ¼ to 5 H.P.

MISC. & SPECIAL

Rotary & Single Punch Tablet Machines ½" to 1".
Belt Conveyors 12', 15' & 20' long.
Anderson & French Oil Expellers.
Gould 75 H.P. Centrifugal Pump 250 PSI.
1—Marco 200 Stainless Steel Homogenizer.
Filling Machines powder, paste & liquid.
1—Howe Mogul Barrel & Bag Packer.
2—Worthington 12"x12"x12" Vac. Pumps.
3—Devine Stokes & Buffalo Vac. Pumps.
Soap Machinery for Toilet, Laundry, Chip, Liquid.
Plastic & Rubber Mills, Calendars, Hydr. Presses.
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CRUSHERS, 7½ x 13 Champ, 9 x 16 Universal, 15 x 24 Traylor, 15 x 24 Diamond portable No. 19 Kennedy Gyratory
CRUSHERS, ROLL, 24 x 24 L.B., & 30 x 30 Jeffrey single, 18 x 24, 30 x 16, 36 x 30 smooth
MILLS, HAMMER, ¾ HP Raymon, 7½ HP Quaker City, 25 HP Williams AKB, 50 HP Jeffrey, 75 HP Gruendler, 100 HP & 150 HP Jeffrey, 350 HP Penna. SXT 13
SCREENS, 40 x 84 Rotex and Roball, 3' x 5' & 3' x 10' double Tyler Hummer, 4' x 10' (2) Cedar Rapids 5 x 10 Diester (3), 5 x 12 Robins Elliptex (2½)
BAG PACKERS, St. Regis TOOLS (unused) single spout for 10# valve bags complete w/motor
COMPRESSORS, AIR, 750 CFM 100 PSI, Sullivan 150 HP slip ring motor
MIXERS, 1-6ef double cone; 5 cf (EAG-3); (EBG-3) 9 cf (EAG-4) Lancaster; 14 cf Clearfield
MILLS, BALL, 8' x 36" 8' x 48" Hardinge, Conical, 5' x 20', 6/6" x 21' tube
MILLS, PEBBLE, 18 x 24, 24 x 24, 30 x 24, 40 x 48, 60 x 48 (new porcelain) 72 x 60, 6' x 8', 6' x 9' Buhrstone, 4½ x 16 Hardinge conical Buhrstone
ROTARY DRYERS, 24" x 28', 44" x 25', 48" x 35', 60" x 45', w/accessories
OVENS, 14" x 32' Ross cont. gas fired, 350° F. for laminating. Like new. 26 cu. ft. Electric 2550° F

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1—Rot. Hot Air Dryer, 9' x 30', St. St. lined.

8—1800 gal. Jktd. & Agit. Steel Digesters, 6' dia. x 8'8" high, dished heads 1" thick, shell 5/16" thick, ⅝" jkt.

1—Davenport #2A Dewatering Press.

1—Detroit Underfeed Stoker, 500#/hr.

1—Robins 3' x 10' single deck screen.

1—Elmore 3-stage washer, 6' W x 10' L x 10' D.

Conveyor, Steel Tanks, Bucket Elevator, Motors, Pumps, etc.

DRYERS

2—A. L. Andersen all stainless steel vacuum shelf dryers, 108 sq. ft., indiv. chambers.

1—Devine #23 Vacuum Shelf, 356 sq. ft.

2—Devine Vacuum Shelf Dryers, Size 17, 80 sq. ft. UNUSED.

1—St. St. Spray Dryer, 19' dia. x 20' high, with Western Precip. nozzles, fans, oil burner, etc.

1—American Double Drum Vacuum Dryer, 36" x 84".

6—Double Drum Dryers: 42" x 120"; 42" x 100"; 32" x 52"; 24" x 60"; 22" x 38".

3—Rotary Hot Air Dryers: 4'6" x 40'; 4'6" x 32'; 3' x 24'.

3—Rotary Coolers: 104" x 30'; 104" x 70'; 5' x 40'.

1—B & S Rotary Hot Air Dryer, 3' x 15', Everdur.

1—Stokes Jacketed Rotary vacuum Dryer, 3' x 15'.

4—Rotary steam tube dryers: Louisville 6' x 30', 6' x 40', 6' x 45' and Ruggles Coles 4' x 30'.

MILLS

1—Allis-Chalmers Compeb Mill, 7' x 24', 500 HP motor.
1—Patterson ball-tube Mill, 5' x 22', UNUSED.
2—Hardinge Conical Mills, 10' x 98".
1—Al. Ch. Cont. ball mill, 6' x 16'.
2—Cont. Pebble Mills, 6' x 8', 4'6" x 12'.
1—Batch pebble mill, 5' x 6'.
1—Raymond #50 Imp Mill.

AUTOCLAVES—REACTORS

6—465 gal. St. St. 3' dia. 8'6" deep, 150# WP, 165# jkt. pr.
3—Pfaudler Glass Lined, jktd. & agit. 30 gal., 50 gal. & 100 gal.
3—St. St. T347 13 gal. 1400# test, 50# jkt.
1—1500 gal., steel, ASME 600# W.P., 150# jkt.

CENTRIFUGALS

1—AT&M Susp. 48" dia. Perf. Basket, St. St. Fume tight.
2—Fletcher Susp. 40" dia. Basket, 1 perf. plain steel, 1 rubber covered imperf.
1—Fletcher 12" dia. St. St. Solid Basket.
3—Bird 24" x 24" Horiz. Centrifugal screen filters, monel.
1—Bird 24" x 38 monel, Solid Bowl.
3—Bird 32 x 50 Solid Bowl Centrifugals, Type 316 Stainless Steel, fume-tight, 60 HP motor. Built 1953.
1—Bird 36" x 50" Solid Bowl, Steel.
1—Bird 40" x 60" Solid Bowl, T304 S. S.
4—DeLaval Nos. 74-11; 94-01 600.
2—DeLaval #BUH-3930 Hermetic Clarifiers, Stainless Steel.
Sharples C-20 Super-D-Hydrator, T316 St. St.
Sharples 16-V, Separator type bowl, T304 St. St.

MIXERS—BLENDERS

1—Gemco St. St. 30 cu. ft. 54" dia., jktd. Conical Blender.
1—Conical Blender, Steel, 6' dia.
3—Sprout Waldron size 12 Ribbon Mixers, 336 cu. ft. work. cap.
4—Stainless Steel Sigma Blade double arm jacketed mixers, 5 gal., 10 gal., 50 gal.
7—Sigma Blade jktd. Mixers, 2¼, 35, 50, 60, 75, 100 gal.
1—Robinson 110 gal. St. Clad jktd. Single Arm mass Mixer.

EVAPORATORS—STILLS—COLUMNS

2—Nickel Clad single effect evaporators, 250 & 400 sq. ft.
1—Bartlett Snow, St. St. Jacketed Evaporating Kettle 6' dia. x 3' deep with heavy duty agitator and 25 HP 4-speed drive.
1—Buflovak size 6.5 model 629D Double Effect, all stainless steel, 588 sq. ft.
2—Stainless Steel Dairy type 6' dia. Vacuum Pans with Coils.
1—Struthers-Wells Single Eff. St. St. 625 sq. ft. vertical tubes.
1—Stainless Steel 145 sq. ft. coil, 500 gal.
1—150 gal. Jacketed Vacuum Pan St. St.
1—Stokes type 316 St. St. Double effect water still, 250 GPH.
8—Copper Bubble Cap Distillation Columns, 24" dia. to 48" dia.

EXCHANGERS—CONDENSERS

3—1070 sq. ft. Stainless Steel shell & tube exchangers, ASME 150#.
3—Stainless Steel Coil Condensers, 40, 55 sq. ft.
14—Stainless Steel Shell & Tube, 13, 20, 24, 55, 135, 183, 200, 250, 400, 425, 1070, 1665 sq. ft.
7—Copper Shell & Tube—95, 108, 185, 275, 525 sq. ft.
1—910 sq. ft. Admiralty tubes, Steel Shell & Heads—UNUSED.

FILTERS

1—Niagara 510 sq. ft. T316 St. St. Pressure Leaf Filter.
2—Sparkler #33-S-26 Filters, Steel Tank, St. St. plates.
1—Feino 6'6" D x 6' Face String Discharge.
2—Eimco 10' x 12" Rubber Covered Filter.
4—Sweetland Filters, #12 (12 lvs.), #7 (20 lvs.), #5 (20 vls.).

TANKS

3—2950 gal. St. St. Heil Milk Trailers.
1—3590 gal. St. St. Fruehauf Milk Trailer.
1—NEW 5700 gal Horiz. St. St. Tank.
1—NEW 10,500 gal. Horiz. St. St. Tank.
1—24,500 gal. Alum. Tank.

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Stokes Rotary Tablet Presses; RB2; BB2; RD3; DD52; Colton No. 10-35.
Baker Perkins (W. & P.) Heavy Duty Double Arm Jktd. Mixers to 300 gal. sizes.
J. H. Day Cincinnattus 1000 gal. Stainless Steel Mixer; Jktd., 75 HP motor.
Readco 750 gal. Double Sigma Arms Jacketed Mixer with Vac. Bowl; 200 HP.
Werner & Pfleiderer 1200 gal. Universal Mixer; Sigma Arms; Jktd., 150 HP.
Bird Continuous Conical Bowl Centrifugals; 18" x 28" and 36" x 50" Compl.
A. T. & M. 26" Stainless Steel under driven Centrifuge; perforate basket.
Tolhurst 40" Rubber Covered Suspended Centrifugals with Monel Plows.
Sharples H2 Nozzlejector with 15 HP Explosion Proof Motor; 1000 GPM.
Sharples C27 Super D Hydrator; Type 316 Stainless; 30 HP Expl. Motor.
8 Stainless Steel Heat Exchangers or Condensers up to 1000 sq. ft. surface.
Barnstead Stainless Steel Steam Heated Water Still; 100 gals. pr hr.
Stainless Steel Vacuum Still; 755 gal. 4'6" x 6'; coil heated.
Stainless Steel Jacketed Vacuum Still; 425 gal.; 56" x 50".
Aluminum Bubble Cap Column 60 Plates; 27½" dia. x 36'; 11 Sections.
Double Drum Dryers with Accessories; 28" x 60"; 32" x 72" and 42" x 100".
Raymond 2 Stage Flash Drying Installation in Type 316 Stainless Steel.
Hersey Rotary Gas Fired Counter Current Atmospheric Dryer; 5' x 26'; S.S.
Squier Stainless Clad Rotary Atmospheric Dryer; 30" x 20'; Hexagon.
Stokes Jacketed Rotary Vacuum Dryer; 34" x 10' Model 59 AB; accessories.
American Two Door Jacketed Sterilizers; all sizes up to 36" x 42" x 84".
Rotary Cutters by Abbe, Ball & Jewell, from Lab. Size to Size No. 1-15 HP.
Mikro Pulverizers from Bantam size in Stainless up to No. 4 Model.
Raymond, Williams, Gruendler, Hammer Mills for heavy duty; all purposes.
Fitzpatrick Model K 7 Comminutating Mill in Stainless with 20 HP motor.
Patterson Buhrstone Lined Model D Pebble Mills; 6' x 5' and 6' x 8'.
International Porcelain Lined X24 Pebble Mills with 50 HP Gear Motors.
Gates Tube Mills 5' x 22' with manganese steel liners.
Hardinge Conical Ball or Pebble Mill; 10" x 36"; Silica Block Lining.
Mojonnier Stainless Steel Vacuum Pan; 6' x 12' with S.S. Condenser Coil.
Four Stainless Steel Horizontal Tanks; 6' x 34'; 7000 gal. Dished Heads.
Blaw Knox Stainless Steel Resin Still or Autoclave; 7'6" x 7'6"; Jacketed.
Two Stainless Steel 5000 gal. Pressure Tanks; 10' x 6' with Agitators.
A. O. Smith Type 347 Stainless Autoclave; 1500 lb. ASME; 1200 gal. Agitated.
Lancaster Stainless Lined Rotary Reactor; 1700 gal. 300 PSI ASME; 50" x 17'4".
Western Precipitation Helo-Flight Desolventizer or Chlorophyll Extractor.

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3500 gallon working capacity Steam Jacketed Double Arm Mixing Tanks.
Stokes, Day, New Era, Hottman Mixers, from 2 to 450 gal., with and without jackets, single, double arm agitators.
Baker Perkins, Day, Readco Heavy Duty, 1 qt. to 160 gals., Double Arm Jacketed Mixers, with Sigma or Fishtail Blades.
Resina LC and Elgin Cappers.
Pony M, ML, World, Ermold, Pneumatic Semi and Automatic Labelers.
Triangle Elec-Tri-Pak Fillers, 1 to 6 Head.
Elgin 5-Head, Hope 1, Filler 2 and 4-Head Stainless Steel Piston Filiers.
Miller, Hayssen, Package Machinery, Oliver, Campbell, Transwrap Wrappers.
Standard Knapp 429 Carton Sealers.
Fitzpatrick Model D S.S. Comminuter.
Mikro 4TH, 3TH, 3W, 2TH, 1SH, Bantam Pulverizers, Schutz O'Neill Mills.
Day, Robinson, Tyler Hum-mer, Great Western, Gayco, Raymond Sifters.

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NEW AND GOOD-AS-NEW EQUIPMENT

1—Stainless Tank #430 Chrome, vert. 7'x10' deep.
20—Jacketed Kettles—Stainless, Copper, Aluminum.
1—Day Mixer, steam jacketed, 50 gal. Sigma Blade.
1—Sperry Filter Press 42", open del. 40-plates, 41-frames.
60—New Pressure Cookers, 18"x18" & 24"x28".
1—New Glass Nash Centrifugal Pump. 100 gpm.
1—New Nash Vacuum Pump Type AL-572.
1—Refluvak Jacketed Impregnating Tank 42"x52".
1—Stedman Disintegrator size 40-6.
1—Jeffrey Vibrating Conveyor 12" x 6", 18' lg.
1—Nash Air Compressor, Type AL 523.
1—Manton Gaulin Stainless Homogenizer 125 gph.
1—I&R Vacuum Pump, 5 H.P., 60'.
4—Heat Exchangers, 12" dia. 11' lg., 43 steel tubes.
1—Raymond 8" Hammer Mill, like new.
2—Louisville Steam Tube Dryers 6' x 38'.
1—New Louisville Continuous Filtering Machine.
2—Stainless Steel Steam Jacketed Readco Mixers.
1—#316 Stainless Reactor, 265 gals. cap., jacketed.
Abbe Pebble & Tube Mill, 5'x22'—Buhrstone Lined.
1—Patterson Ball Mill, porcelain lined 17"x27".
1—Patterson Ball Mill, 42x36 jacketed.
2—Large Steam Jacketed Horizontal Mixers.
2—Ribbon Type Mixers, 50 & 90 cu. ft.—like new.
2—Steel Tanks 90,000 gals., ea. vert. welded const.
2—Ball & Jewell #2 Cutters with 75 H.P. Motors.
1—J. H. Day 3-roll Mill 9x16.
3—3,000 gal. Jacketed Kettles with Turbo Agitators.
1—#10 Day 300 gal. Jacketed Sigma Blade Mixer.
4—New Heat Exc. 60' with Cupro Nickel Tubes.
1—Sparkler Stainless Filter Model 33-B-9.
3—4'x8' Shaker Screens.
6—W & P Mixers, jacketed, heavy duty, sigma blade 300 gal. with hydraulic dumpers.
3—Baker-Perkins Mixers—same as above.
2—Sperry 30" Filters, clsd. del., 35-pl. 40-fr.

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PROCESSING EQUIPMENT

LIQUIDATION

Grinding and Process Equipment

PHILADELPHIA, PA.

1—Williams 4 Roll Mill complete with motor, drive and all auxiliary equipment.
1—Raymond 3 Roll Low-side Mill, complete with motor and all auxiliary equipment.
1—Sprout-Waldron Style B Ribbon Blender, 336.9 cu. ft., 10,000# capacity.
1—Sprout-Waldron Horizontal Ribbon Blender, #9B, 3180# capacity, complete with motor and drive.
1—Sturtevant Dry Batch Mixer, 1½ ton, 75 cu. ft. capacity, complete with motor and drive.
1—Readco Steel Jacketed Double Sigma Blade Vacuum Mixer, 25 gal. capacity, 125# jacket pressure.
1—Mikro #2DH Pulverizer complete with 15 HP motor and #36 Mikro Collector.
1—Steel Jacketed, 1000 gal. Reactor complete with motor drive and agitator, jacket 125#, internal 75# pressure.
3—Robinson Type 316 Stainless Steel Sigma Type, Jacketed, Heavy Duty Continuous Mixers, complete with 60 HP drive and motor, 400 gal. cap.
1—Leader Stainless Steel Jacketed Ribbon Blender, with 15 HP motor and drive.
1—Process Engineers Stainless Steel Jacketed Ribbon Blender, 2'6" x 9'6", complete with 10 HP drive and motor.
1—Readco Stainless Ribbon Blender, 285 cu. ft. capacity with 30 HP motor and drive. Capacity 2120 gal.
1—Baker Perkins Stainless Steel Jacketed Vacuum Dispersion Mixer, 100 gal. cap., 60 HP motor.
1—Baker Perkins #16 TRM, 150 gal. Jacketed Sigma Blade Vacuum Mixer, with 60 HP motor.
1—Baker Perkins #15 VUMM, 100 gal. Jacketed Dispersion Blade Mixer with 100 HP motor.
1—Baker Perkins 100 gal. Stainless Steel Jacketed Double Arm Sigma Blade Mixer, Size 15.
1—National-Erie Pilot Plant Double Arm Dispersion Blade Jacketed Vacuum Mixer with 5 HP motor.
1—Stokes Stainless Steel Granulator, No. 43A.
2—Howe, 40 cu. ft. Rubber Coated Ribbon Blenders.

DRYERS & KILNS:

3—Link Belt Stainless Steel Roto-Louvre Dryers, Model 207-10, 310-16, 502-3.
1—Louisville Experimental Rotary Dryer, 12" x 7'6"
2—Ruggles Coles Rotary Dryers, 4' x 20' and 4' x 30'
1—Traylor Rotary Dryer, 4' x 40'
1—Bartlett & Snow Rotary Dryer, 4'6" x 36'6"
8—Stokes Single Door Vacuum Shelf Dryers, 6 and 4 shelves
2—Buflovak Double Drum Dryers, 42" x 120"
1—Stokes Double Drum Dryer, 5' x 12'
1—F. L. Smidth Rotary Kiln, 8'2" x 132', Complete
2—Rotary Dryers, 6'4½" dia. x 45' long, Complete
1—Rotary Kiln, 2' x 14', Complete



THE GELB GIRL
October 1957

FILTERS:

1—Sparkler Stainless Steel Jacketed Filter, Model 1458
2—Impco Rotary Vacuum Filters, 5' x 4', with vari-speed motor, drive and vacuum pumps, complete
2—Feinc Stainless Steel Rotary String Filters, Size 5' x 6'
2—Niagara Stainless Steel Filters, Models 510-38 and 26-60-4
1—Bird Continuous Centrifugal Filter, Model 24" x 36"
1—Sweetland #7 Filter with 20 steel leaves
10—Sweetland #12 Filters with 72 Stainless Steel Leaves
1—Feinc Stainless Steel Rotary String Filter, 3'x3', New

AUTOCLAVES, KETTLES AND TANKS:

3—Stainless Steel Vertical Storage Tanks, 3,000 gal. each
1—Combustion Engineers Steel Jacketed Autoclave, 1,400 gal., complete with Agitator and Drive. W. P. Jacket 150#, W. P. Shell: 600# ASME Code.
1—Buflovak Stainless Steel Jacketed Reactor, 250 gals.
1—Pfaudler Glass-lined, Series R, Jacketed Kettle, 500 gals.
1—Pfaudler, Glass-lined, Series S, 75 gal. REACTOR
2—Steel Vertical Rubber-lined Storage Tanks, 1,000 gals. ea. NEW

CENTRIFUGALS:

1—Baker Perkins Ter Meer, Type 316 Stainless Steel Centrifugal, Model HS 24"
1—AT&M Link Suspended Type Centrifuge with 28" Stainless Steel Perforate Basket
2—Sharples Type 316 Stainless Steel Centrifuges, Model #D-2
1—Tolhurst Rubber lined Centrifuge, 20" basket, base bearing type.

MISCELLANEOUS:

1—E. B. Badger Steel Bubble Cap Column, 24" x 24', with 15 trays
1—E. B. Badger Stainless Steel Bubble Cap Column, 3' x 7', with 10 trays
1—Vulcan Type 316 Stainless Steel Bubble Cap Column, 3' x 31', with 30 trays
2—Combustion Engineering Waterproof Package Boilers, 200 HP, 275# pressure
5—Davis Engineering Type 347 Stainless Steel Heat Exchangers, 200 sq. ft. ea. NEW
1—Komarek Greaves Briquetting Machine with 50 HP motor
1—Ingersoll Rand Air Compressor, Type PRE-2 with 300 HP motor

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B.F.Goodrich report:



Rubber calms the shudder that cracks metal

B. F. Goodrich improvements in rubber brought extra savings

Problem: That white stuff is a chemical used in making asphalt. But the combination of it, plus hot water and scalding steam set metal tanks to vibrating, soon cracked the lead lining. Acid leaked out. Even with repairs every month, tanks weren't lasting more than two years.

What was done: B. F. Goodrich engineers suggested rubber lining the tank with "Acidseal MA". This soft rubber lining absorbs vibrations, won't crack. It stands corrosion, most acids and chemicals, resists abrasion better than the hardest steel.

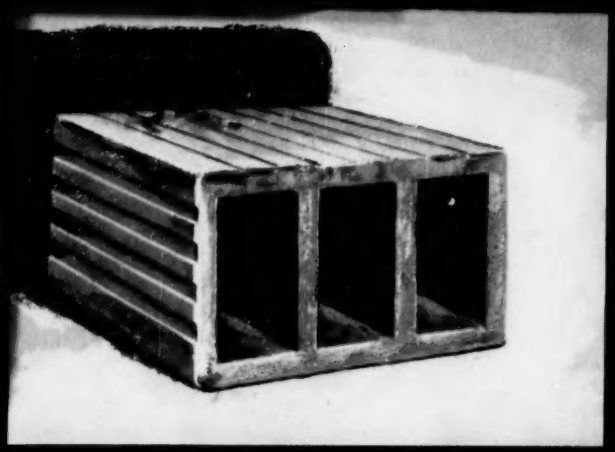
Savings: Installed four years ago, the B.F.Goodrich rubber-lined tank shown here still shows no sign of wear, has needed no repairs. Other B. F. Goodrich rubber-lined tanks in this plant have given seven years of troublefree service.

Extra benefits: This company, like other Southern companies, made an additional saving by having their tanks lined at the B.F.Goodrich plant at Tuscaloosa, Alabama. They saved on freight costs, got faster delivery.

Why specify B. F. Goodrich: When you buy B.F.Goodrich lining you buy years of engineering background with it—experience that makes sure your lining will be exactly fitted to meet all the special requirements of your work. *B.F.Goodrich Industrial Products Co., Dept. M-183, Akron 18, Ohio.*

B.F.Goodrich

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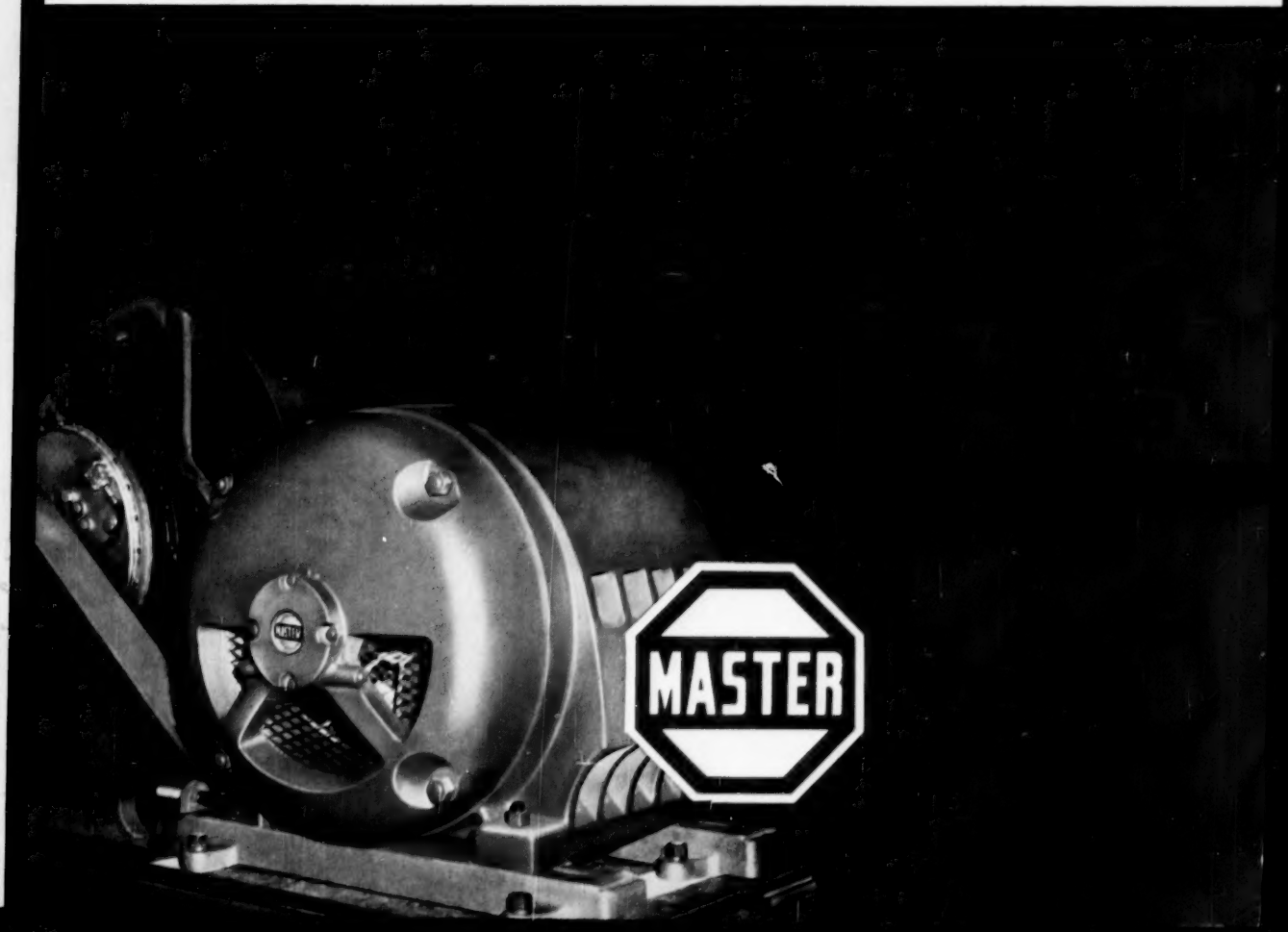


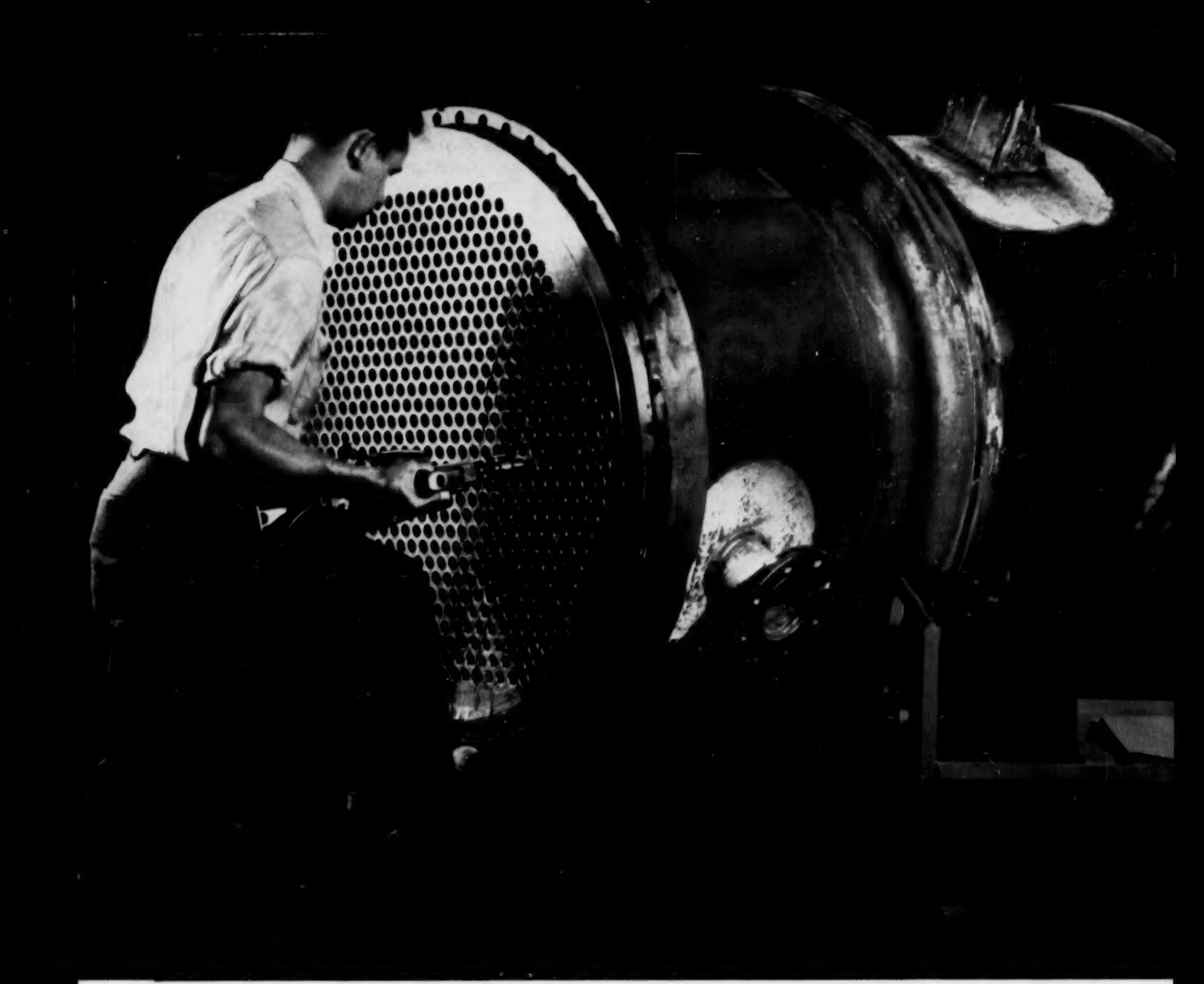
No Margin for Air– No Margin for Error

ANOTHER DRIVE REQUIREMENT MEETS ITS MASTER

Yes, it's a fact—unless you remove the air from the clay, you get a no-good tile. And whether air is your problem, or not—error is always a problem. And it's never a mistake to come to Master for the right power drive. In every kind of industry, Master customized package drives give you the utmost in flexibility, compactness and performance.

Here, the primary requirement is power—and the husky, big 200 H.P. Master fills the bill year in and year out. Your requirements might be better met by integrating Master components into a single, efficient, compact unit for the right horsepower, right shaft speed and right mounting features. What are they?





Now you can get single- and double-pass heat exchangers in *two weeks' time*

Speed of delivery—as well as versatility — enables you to use *standard* heat exchangers in place of higher-priced custom units. Now you can get a "flexible-standard" unit—*in only two weeks' time.*

The flexibility provided by Pfaudler's pre-stocked stainless steel exchangers puts an end to many of your designing and estimating problems. Both single- and double-pass units are available (on a two-week delivery basis!) in a variety of sizes ranging from 56 to 316 square feet.

Each model can be delivered with either long or short bonnet. All bonnets are fabricated after receipt of your order, so you get the flexibility of either single- or double-pass design.

These "flexible-standard" units are adaptable to vertical, inclined, or horizontal installation. Actually, they offer you many of the features you probably look for in custom-built heat exchangers.

One way to minimize your costs is to check with Pfaudler *before* you set out to install that "custom" unit. Pfaudler's "flexible-standards" and two-week delivery point the way to substantial savings.

Contact your Pfaudler representative for more complete information. Or, if you prefer, write direct and ask for Bulletin 837.

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